ELECTRICAL REVIEW

28th AUGUST, 1953

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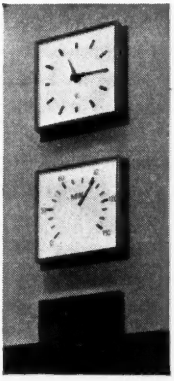
LOAD INDICATORS AND TELEMETERING EQUIPMENT

1.

Everett Edgcumbe design and make Summation and Telemetering Equipment for load and other indications.

Each scheme is individually engineered and the method used, either electronic or electro-mechanical, is chosen to suit circumstances.

2.



3.

The illustrations show some typical remote indicators — they may be either direct or Servo operated.

1. *40″ diameter illuminated double sided summation indicator with remote controlled impending load pointer.*

2. *Turbine Room load indicator and clock in 4′ 0″ square illuminated cases.*

3. *4′ 0″ square double sided illuminated total load indicator.*

EVERETT EDGCUMBE

Makers of electrical instruments for indicating, recording and controlling; photometric apparatus; process controls.

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ELECTRICAL REVIEW 28th AUGUST, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. 153 • NO. 9

Energy Storage

THE world tendency for the demand for electricity to outstrip economically exploitable power resources has caused closer attention to be paid to securing the fullest use of the more readily available generation sites. An example is provided by hydro-electric schemes in which tail water from the stations is pumped during times of light load from low level to high level reservoirs, whence it is released to deal with peaks, or in which it can be stored against seasonal demands. The most notable of its kind is the Schluchsee works of the Rhenish Westphalian undertaking (R.W.E.) in Western Germany (to which reference is made on page 442 of this issue), where the capacity of the pumps in three stations appears to be nearly half the present total in all countries. By this means the amount of energy produced from the normal run-off of the watershed has been almost doubled and the electricity potentially available from storage water can be fed during peak hours as required into an extensive high voltage transmission network. The R.W.E. owns earlier and smaller pumped storage plants associated with continuously operated run-of-river and steam plants. Peak and emergency duties can be dealt with much more quickly by water-power stations, but steam plants are said to supply some of the kWh required for off-peak pumping.

This raises the question whether pumped storage is likely to prove a feasible adjunct to systems depending mainly on coal-fired stations situated within easy transmission distance of hilly country. The virtual effect would be to transfer day peaks, usually carried by less efficient generating sets, to more modern stations as a night load. The economic balance would depend upon the value of the plant released during busier hours and the saving in operating costs of obsolete plant. The margin of gain would have to be wide enough to pay for high and low level reservoirs, transmission lines, hydraulic turbo-alternators and pumps with allowance for losses in

pumping, which are in the ratio of 1·75 to 1 at Schluchsee. Elimination of boilers and high-pressure steam pipes, and low depreciation charges on civil engineering works, are favourable features. There are probably few suitable sites in Great Britain, but the number of variable factors is great and pumped storage as a general principle may offer opportunities in many countries which are as yet undeveloped electrically.

RIGHT HAND, LEFT HAND

In removing gas and electric water heaters from the scope of the Hire Purchase (Control) Order last week the Board of Trade had to justify this "discrimination." Therefore it stated that the action was in accordance with the Government's measures for improving fuel economy. This "economy" point, of course, is one of the principal arguments of electric water heater manufacturers in favour of the abolition of purchase tax on their products. So far it has had no effect. Now the Commissioners of Customs and Excise should be asked to justify their refusal to remove the tax from electric water heaters in view of the declaration of Government policy on the subject.

ENGINEERING EXPORTS

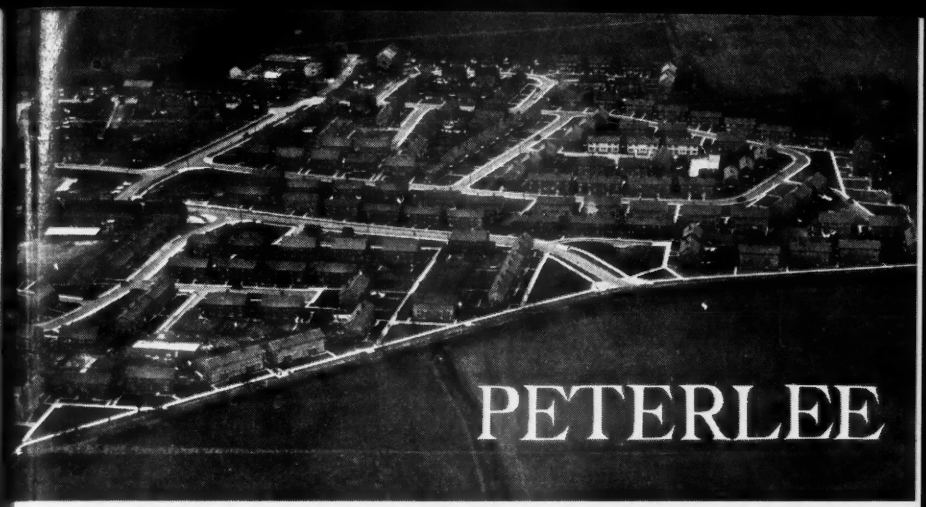
About a third of the production of British engineering industries is exported and this applies, too, to the electrical machinery section and other branches of electrical production. The electrical industry's exports are being well maintained as also are those of our principal competitors, the United States and Germany. Curves reproduced in the July *Bulletin for Industry* (a Treasury publication) show, however, that in all three cases the curves flattened out last year after a steep rise in 1951 in the case of Germany and steadier increases in British and American exports. In the current year, the *Bulletin* says, this country "may have lost a little ground; and there is no reason to suppose that at the moment our engineering exports are rising faster than those of the other two countries."

RUBBER INSULATION

The most important feature of the new B.S.7, as now published, is the reduction permitted in the insulation thickness for 250 V rubber insulated cables and flexible cords, which will make a considerable saving in the amount of that raw material which has to be imported. This development, due mainly to research in rubber technology during the past few years, has entailed consequential revisions of the British Standard for cables and flexible cords in ships and those insulated with vulcanized rubber as used in collieries and with polyvinyl chloride. Particulars of these revisions are given on page 436 of this issue.

ON THE CHEAP

Four residents of Frant (Sussex) are naturally indignant because, after they had paid £950 for an electricity supply to their premises, a fifth resident was connected to the line without being asked by the South Eastern Electricity Board for a contribution. The Board, in declaring its inability to make a refund to the complainants, says that the point frequently arises. No doubt the Board is right, but it is unfortunate that such cases are frequent. It would be more satisfactory if the cost could be reapportioned; as matters stand the only hope is that the newcomer will display a certain amount of goodwill. The nearest thing to a remedy is the system instituted by the South Western Board whereby a group of rural consumers is made responsible for the line rental. This rental is allocated among the members; anybody joining the group presumably pays his share, thus easing the burden all round.



Electricity Supply Arrangements for the New Town

THE new town of Peterlee in the rural district of Easington, Co. Durham, differs somewhat from other new towns now being established. Instead of being intended, by the provision of inducements in the way of new industries as well as modern houses, to restrict to some extent the further growth of large existing settlements, Peterlee is being built primarily with the object of stopping the drift of population away from the surrounding area to the towns. Employment is available for able-bodied men in coal mining, but this is practically the only industry of any size, and it is the intention to encourage the setting up of other lighter industries for men for whom mines are unsuitable or uncongenial as well as for women. To take a longer view, the scheme has also in view the time when, with the mechanization of the mining and the gradual exhaustion of the coal seams, recruitment to the mines, even of able-bodied men, will decrease.

However, not only the surrounding district but also the whole of the 2,350 acres with which the Peterlee Development Corporation is dealing must at present be regarded as an active coal mining area and this has dictated the phasing of the development of the various zones. The whole site of the town is underlaid with coal of from one to five seams, estimated to amount to about 30 million tons. By agreement with the National Coal Board about 1 million tons of this is to be permanently "sterilized" beneath the portion of the site reserved for the town centre so that with full stability work can proceed upon public and commercial building. It is the intention to extract all the rest of the coal.

This decision imposes severe limitations on the pattern of building development, the effect of subsidence being the major influence in the plan. The N.C.B. has, however, given estimated dates at which each section of the coal workings will be extracted and research has been carried out to determine the behaviour and effects of previous subsidence in the area. Information has also been gathered about the various means of combating subsidence under buildings. This has enabled the Corporation to plan ahead a phasing of development which will ensure a continuity of building contracts and an orderly and cohesive programme of residential and educational building around the town centre.

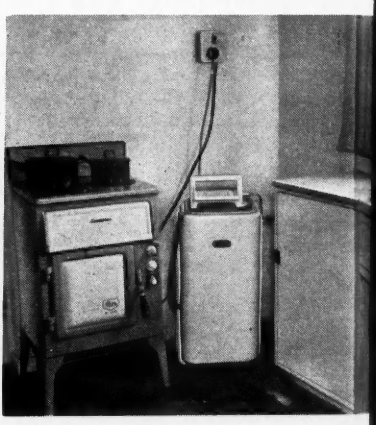
Apart from a shopping centre, schools, technical colleges, hospitals, churches, etc., it is proposed to erect eventually about 8,000 dwellings accommodating 30,000 persons. So far about 1,000 houses have been built and the present building target

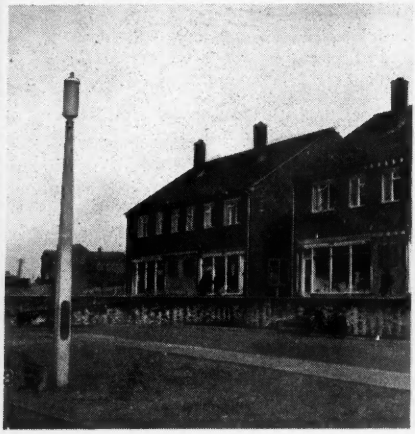
is 500 a year. A choice of nearly thirty different types of houses with from one to four bedrooms is being provided, together with a number of blocks of flats restricted to three storeys.

Building work commenced first in August, 1950, near Horden, this section being designated Thorntree Gill. The original scheme, now completed, comprises eighty-two houses in semi-detached pairs, two blocks of three-storey flats containing twenty-four dwellings in all, and a general stores. The second section of the scheme, in the Eden Hill area, was commenced in September, 1950. Here about 900 houses have so far been completed, as well as eight shops. Junior and infants' schools are now being built, the infants' section being expected to be open in September. A private brewery company has commenced the erection of a public house close to the eight shops. The County Council has also begun the construction of a fire station in the town centre, as well as the first phase of a large technical college.

It will be appreciated that piecemeal building necessitated by attention to subsidence renders the provision of an electricity supply anything but a straightforward matter. It may well be that one area is

(1) A corner of Thorntree Gill, the first section of the new town to be completed. (2) A typical kitchen at Thorntree Gill. (3) The shopping centre at Yoden Road, Eden Hill, with a G.E.C. pole-top mounted vertical lantern in the foreground. (4) Typical houses on the Eden Hill site. The street lighting unit is a G.E.C. "Two-Forty" lantern on a Tarslag "Broadcrete 500" column



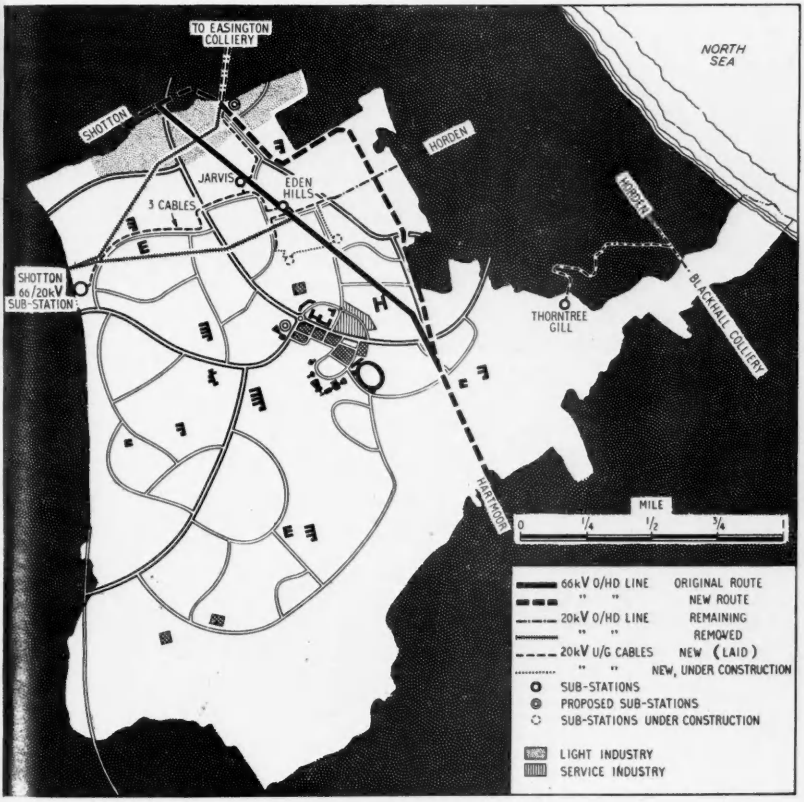


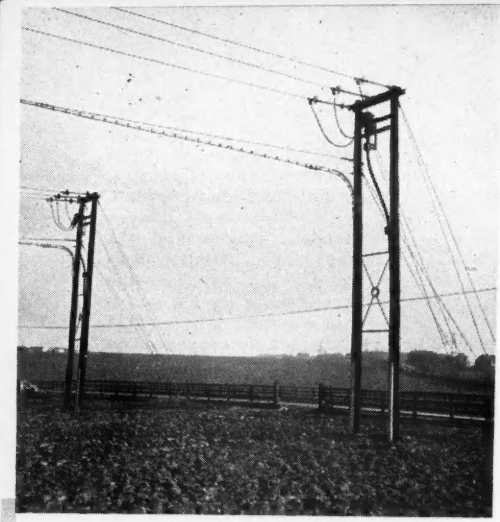
ready for development while an adjoining area may not, on account of the necessity to wait at least five years after extraction of the coal beneath, be fit for building for perhaps another ten years. This obviously does not make for economical distribution, since it involves the provision of long lengths of h.v. lines, as well as, in many cases, transformers and switchgear operating at only a fraction of their capacity.

Ultimately the North Eastern Electricity Board, Wear Sub-Area, expects to provide thirty-three transformer substations with capacities ranging from 300 kVA to 750 kVA. So far 5¼ miles of h.v. underground cable and three substations have been provided and two are under construction. The scheme has involved the rerouting of 1·41 miles of 66 kV overhead line and the undergrounding of 1·89 miles of 20 kV line. The present stage of development is as shown on the accompanying map.

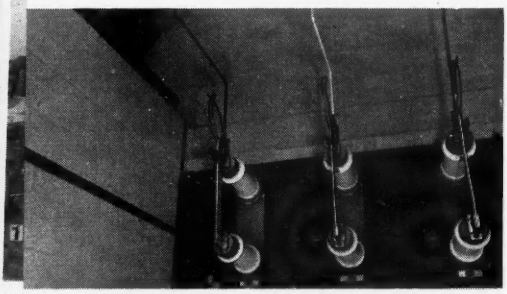
The layout of the substations follows a more or less standard pattern and the installation at the Jarvis substation may be taken as typical. A loop from the Easington Colliery–Shotton 20 kV line is taken to a pair of Reyrolle A6T/X2/QM turbulator spring charged remote controlled switches, a similar switch controlling a tee-off supply to Shotton Colliery. Copper ceiling busbars carry the supply to the Parsons 500 kVA 20 kV/415 V three-phase transformer. Metrovick isolator switches

Plan of the new town of Peterlee showing overhead lines, underground cables and substations. Public buildings, fire station, hospital, schools, shops and offices are also indicated





Part of undergrounding of the 20 kV overhead feeders from Easington Colliery to the Jarvis and Shotton substations



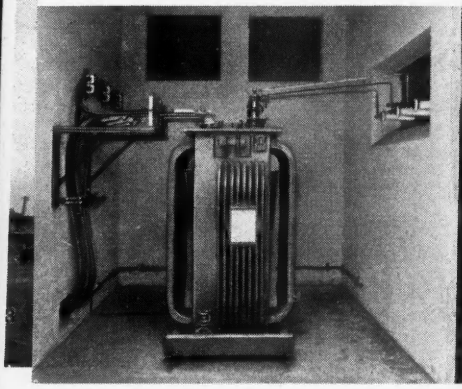
control the l.v. supply to the surrounding area. The substation also accommodates the Standard Telephones street lighting control equipment operating on the l.v. d.c. bias system and incorporating Venner time switches.

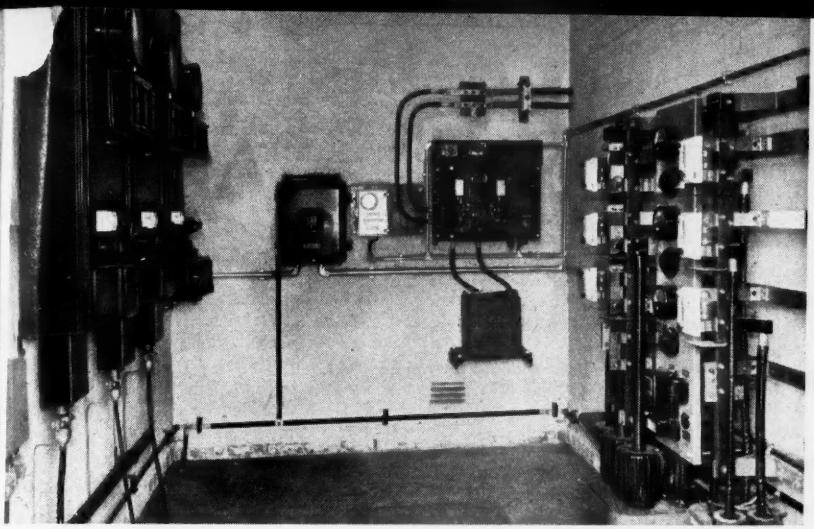
Each house is provided with an adequate t.r.s. electrical installation, which includes a cooker, washboiler and water heating circuit with 13 A socket outlets in each of the principal rooms connected on a ring main circuit. An open coal fire is provided for water heating.

The Peterlee Corporation's initial intention was to install either electric or gas cookers and washboilers in all houses at the option of the tenant, the hire charges for this equipment being included in the house rent. This policy has recently been altered and the tenants are now required to provide cookers and washboilers at their own expense. Despite strong competition, a large amount of electrical equipment has been installed to date, 60 per cent of the houses having electric cookers and washboilers.

The average consumption of electrical energy in the "all-electric" house (excluding water heating) is 2,392 kWh per annum. Applied to a five-roomed house on the Board's two-part domestic tariff, the cost amounts to £11 8s 7d. In the case of the houses using electricity for lighting and small appliances only (iron, vacuum cleaner, kettle, radio, etc.), the annual average consumption is 381 kWh, which applied to a five-roomed house on the Board's domestic block tariff amounts to £4 9s 4d.

At Jarvis substation:—Above: 20 kV quick break air isolators and (below) Parsons 500 kVA 20 kV/415 V 3-phase transformer and Reyrolle 20 kV spring charged remote controlled switchgear





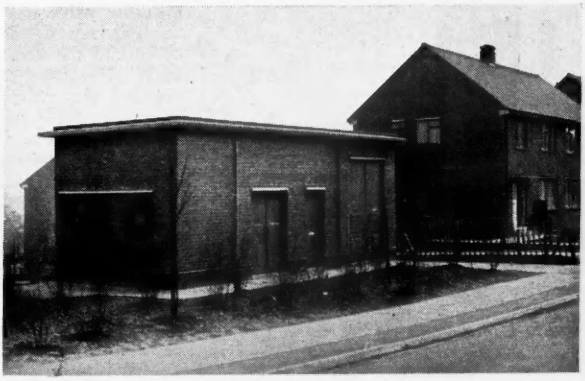
Low voltage chamber at the Jarvis substation

In connection with the payment of electricity accounts, in addition to the normal method of quarterly payment, the Board has introduced a domestic special collection scheme whereby tenants make previously agreed payments to the Board's collectors who call fortnightly, the payments being based on the anticipated annual consumption in relation to the consumer's electrical appliances. At the end of each year the meters are read and adjustments in payments are made according to the consumption recorded. If required, hire-purchase payments are also included in the fortnightly payments. It is of interest to note that 90 per cent of the tenants have adopted this easier method of payment, and no prepayment meters have been installed.

The public lighting installations so far extend only to the area in which housing development has taken place, and conform to the Class "B" category. The main road Class "A" scheme is still under consideration. The present Class "B" installation consists of 159 units comprising G.E.C. "Two-Forty" lanterns, and Siemens "Wilton Sieray" lanterns each housing two 2ft 40 W fluorescent tubes. In addition there are twenty-seven 80/90 W mercury vapour Metropolitan-Vickers S51 lanterns. The installation is controlled by the Standard Telephones d.c. bias injection method of remote control.

For their assistance in preparing this article we should like to thank Mr. A. V. Williams, general manager of the Peterlee Development Corporation, and Mr. E. A. Nicklen, his assistant; Mr. E. C. Lennox, manager, and Mr. H. Ainsworth, commercial officer, Wear Sub-Area, North Eastern Electricity Board; and Mr. H. Widdrington, commercial engineer, Hesleden District.

Substation serving Thorntree Gill, the first estate to be developed

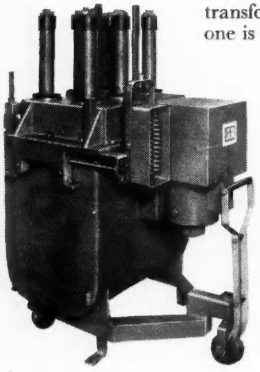


New Circuit Breaker

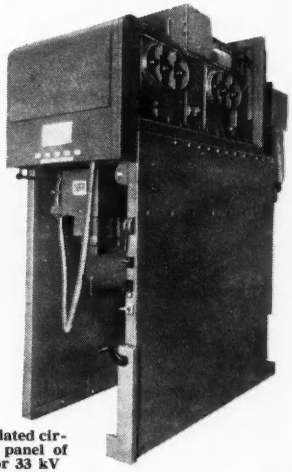
Single Construction Satisfies Diverse Requirements

A VERTICALLY-ISOLATED metal-clad circuit breaker of 750 MVA for 33 kV has been designed by A. Reyrolle & Co., Ltd., to meet a demand for switchgear occupying little space and easy to operate. It is identified as the 442T-type and only one construction is required, whether this breaker is to be employed for single or duplicate busbars, whether for feeder, generator, or transformer circuits, or for busbar-section or busbar-coupler panels. Provision is made for earthing the line or the busbars by a novel method that does not require ancillary apparatus and the arrangement is such that the line or the busbars are earthed within their own zone of protection.

In a duplicate-busbar panel one set of busbar orifices is situated on either side of the circuit orifices so that the breaker can be plugged in to select the required busbar. At the same distance on the other side of the busbar orifices are earthing plates and either busbar can be earthed by plugging in the breaker at the appropriate position and closing it. A second set of circuit orifices is provided beyond the current transformers, so that the circuit can be earthed within the zone of its protection. The latter orifices are also used for the voltage transformer when one is needed.



Breaker completely removed on truck



Vertically isolated circuit breaker panel of 750 MVA for 33 kV

The breaker is easily moved from one position to another by a lifting and traversing carriage, captive in the panel, operated from controls on the front of the panel; lifting is done electro-hydraulically, lowering by gravity and traversing by hand. The operation is so simple that it is possible to transfer a circuit from one busbar to the other in less than three minutes.

In lowering the breaker, the motor-operated pump causes the arms of the carriage to rise and take the weight of the breaker, the anchor bolts securing it to the frame standards are withdrawn, the lowering valve is opened and the ram of the carriage descends with the breaker, the oil in the ram passing into a storage tank. To move the breaker to a new position the position-selector handle on the front of the panel is set appropriately and the carriage is moved backward or forward with the breaker by manually cranked screw mechanism. When the carriage reaches the selected position a locking bolt registers automatically and the motor can then be switched on to lift the breaker to its fully-home position, where it is anchored to the frame standards.

The same carriage is used to lower the voltage transformer when it needs maintenance or when the circuit or the back busbar is to be earthed. For maintenance,

the voltage transformer is transferred to a bogie in the passageway behind the switchgear; but when the circuit or the back busbar is to be earthed, the voltage transformer may be left in its lowered position on the carriage. The various operations involved in the transfer of the breaker from one position to another are interlocked to prevent wrong operation.

There is an extra interlock at each of the earthing positions; the carriage cannot be locked in the selected earthing position until a key has been obtained to unlock a safety gate; the key can then be removed, but it is required again when the carriage is to be moved to another position. As a different key is needed for each earthing position, it is impossible to select any of the earthing positions inadvertently.

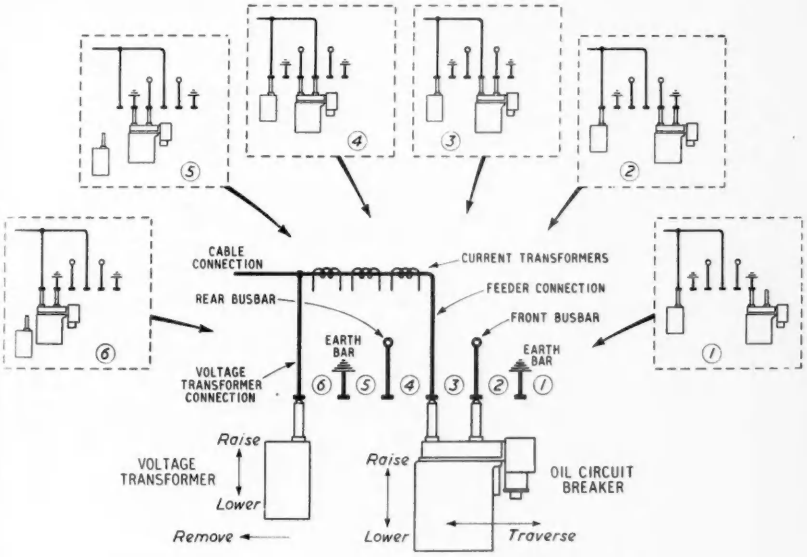
Orifice shutters are opened and closed by the raising and lowering of the breaker and can be padlocked in either position. If the breaker is raised against a closed shutter, the oil in the ram is automatically by-passed to the storage tank without damage.

The breaker is fully phase-separated, having two breaks per phase. Both the main and the arcing contacts are of the butt type and the circuit is broken in arc-control devices which are easily removable by virtue of their breech-block fixings. The isolating contacts are also of the butt-type and allow considerable latitude of alignment in all directions.

The solenoid-operated closing mechanism has a single dashpot for opening and closing situated in front so as to be accessible for adjustment. A special attachment containing a spring for use in an emergency, if the solenoid should become inoperative, is capable of closing the breaker at its full making capacity. When it is to be used, the spring is charged, the attachment is fixed on the breaker mechanism, and the spring is tripped by hand to close the breaker.

All maintenance of the breaker can be done with it on the carriage in front of the panel. In order to permit the transfer of breakers between panels a light three-wheeled truck which does not need floor rails is provided.

Single or duplicate busbar panels are available, with sheet-steel double-barrier frame standards accurately drilled to



Diagrammatic representation of breaker in different positions in duplicate busbar panel. (1) Maintenance, (2) front busbar earth, (3) front busbar service, (4) rear busbar service, (5) rear busbar earth, (6) feeder earth

ensure correct positioning of the chambers, which are lifted between the standards during erection. All orifice insulators are of bakelized paper, capacitance graded, and they are identical for all chambers.

The busbars are of circular solid copper rod, tape-insulated, and in compound-filled chambers. Self-aligning links with silver-plated contact faces which allow for longitudinal expansion are used to join the busbar conductors of adjacent panels and are contained within compound-filled elliptical band joints.

There are two busbar ratings, of 1,200 A and 1,600 A, and they may be phase separated or not in the same size of chamber. Flat silver-plated contacts in the busbar orifices ensure good current transfer from the scissor-type isolating contacts of the breaker and there is provision for inserting a h.v. or current-injection test plug into any of the orifices.

The bar type bushing-mounted current transformers, in air, behind sheet steel covers at the top of the fixed portion, are accessible for testing. They can be removed on site by draining the oil from the top portion of the front vertical connecting chamber and removing a door on it, which permits removal of the front connection to the bushing and also the top portion of the chamber itself; the current transformers can then be drawn forward off the bushing, which remains connected and supported at the back end; the c.t. chamber connections can be phase-separated or contained in a common chamber. The voltage transformer is phase-separated and oil-filled, having a h.v. fuse in a separate compartment in each plug bushing.

Three single-core cables or one three-core cable can be connected through cable boxes in conjunction with a common adaptor chamber; for other combinations a larger adaptor chamber with identical fittings is supplied. The multicore-cable gland is housed inside one of the frame standards, where it is fully protected, the multicore-cable terminals being accessible from the floor at the rear of the panel.

Revised Cable Standards

THE following British Standards relating to cables have now been published by the British Standards Institution, 2, Park Street, London, W.1:—

Rubber insulated cables and flexible cords for electric power and lighting, B.S.7 : 1953 (10s), supersedes the edition of 1946 and incorporates many of the requirements of Government Department Electrical Specifications Nos. 1, 8, 9 and 10. It also supersedes the supplement to the previous edition relating to polyvinyl chloride as an alternative to vulcanized rubber, which is now covered by B.S.2004, referred to below.

The main changes in B.S.7 are in the reduction of insulation thickness permissible for voltages up to 250 V and to a lesser degree for 11 kV and 33 kV, and in the incorporation of the quality clauses introduced by an amendment of 1949; the chemical and physical tests, based on B.S.903, have been extended to apply to the rubber sheath. Compositions of rubber insulation and tough rubber sheath are also specified. Other new features concern thicknesses and bending tests for aluminium sheath and the use of hard drawn copper conductors for overhead house services. The standard reference temperature throughout the specification is now 20 deg C.

The Standard relating to polyvinyl chloride insulated cables and flexible cords, sheathed or unsheathed, B.S.2004 (6s), covers voltages up to 250 V. Insulation thicknesses are similar to those for corresponding rubber types, except for unsheathed single-core cable when the thickness is greater. A fire-resisting test is included.

The B.S. for cables and flexible coils for electrical equipment of ships (including electrical propulsion), B.S.883 : 1949, has been brought into line with B.S.7 : 1953 as regards insulation and sheath thickness for v.r. cables by an amendment (PD1665) (3s), which also introduces a range of 250 V mineral insulated copper sheathed cables, having up to seven cores, similar to the 660 V cables already included. Overall diameters with tolerances are also specified

Wire armoured v.r. insulated cables for collieries, B.S.2008 : 1953 (5s), deals with twin and three-core 250 V lighting cables (other than for coal face lighting) as well as 660 and 3,300 V shaft and roadway cable. Insulation thicknesses correspond with those in B.S.7 : 1953. Dimensions are stated for each size of cable with single- or double-wire armouring and served overall with hessian tape or taped and braided. Copper wires may be included in armouring up to specified numbers so as to achieve the required conductance. Physical and chemical test methods are based on B.S.7.

Alternatives to Mica

A Comparison with Other Materials

By E. R. HAINES*

SINCE the earliest days of the electrical industry mica has been recognized as a first-class insulating medium and it is difficult to imagine electrical apparatus, especially rotating machinery, which does not include this material somewhere in its insulation. Its excellent electrical properties, mechanical strength, chemical inertness and resistance to high temperature place it in a class by itself and generations of engineers have learned to look on it as the standard where reliability is concerned. This belief, however, because of the manner in which mica has to be used, is not always justified.

Mica is widely distributed over the face of the earth, but only in a few localities does it exist in sufficiently large quantities to make mining a commercial proposition. There are many varieties of mica, but the two most generally used for electrical purposes are Muscovite or white mica and Phlogopite or amber mica. India supplies most of the mica which is used in the electrical industry, and this is principally Muscovite. Most Phlogopite mica comes from Canada.

Mica is mined mainly in the form of small slabs or blocks which, after trimming, are called " books " and are usually only a few square inches in area and from 0·5in to 2in thick. Only occasionally are crystals of any appreciable size brought to light, but the interior of these is often waterlogged and useless so that the defective portions have to be cut away. For this reason, except in a few special instances, mica is rarely used in its original form. The thinness of the splittings, their flatness and flexibility are features that adapt the mineral to the formation of laminated structures in which the flakes are bonded together with a suitable adhesive.

Many combinations of mica with adhesive and backing are used in the insulation of electrical apparatus, but they can be generally classified under the following headings—(1) hard micanite plate or segment mica, (2) moulding micanite, (3) flexible micanite, (4) composite mica wrappings, and (5) heat-resisting micanite.

Disadvantages of Mica as Used

Individual flakes of mica have a high electrical strength of about 1,000 V/mil, but this figure is rarely obtained with composite sheets. The reduced electrical strength is due almost entirely to the method of manufacture. In producing mica in sheet form for moulding, etc., the mica splittings are sorted by hand into as nearly as possible uniform thickness. In the case of hand-made sheets, the splittings are then distributed in a layer, each flake overlapping the next. Another and cheaper method is where the sheets are made by " scattering " the flakes by machine, but uniform thickness cannot be obtained in this way.

With a single-layer sheet there is a danger that pinholes, faults in the mica flake and missed patches may occur. Pinholes are commonly found in thin mica flakes and tears are often present, especially near the edges. Missed patches are dependent on the skill of the operator and rarely occur in the products of reputable manufacturers. However, the flakes can be damaged in handling, either on account of excessive bending, or by the thumbnail during sorting. For these reasons the sheets are normally composed of at least two layers, the second layer tending to cover up the missed patches, or faulty mica flakes. The electrical breakdown of a two-layer sheet, therefore, can be no greater than that of a single mica flake, whereas the volts per mil have been halved. As it is usual to design the insulation to have a high safety factor, it is

* Research Department, Crompton Parkinson, Ltd.

necessary for the build to be twice that which is in theory required.

For big industrial machines, this build does not usually matter, but the modern demand is all for reducing the physical size of electrical machines while maintaining the same output. A typical application where the size to output ratio is important is in the case of traction motors. Here it is common practice to mould both field and armature coils so as to reduce the insulation space factor to the minimum. It is in this connection that most of the troubles of using composite mica occur.

Moulded coils are generally made using mica sheet which is backed with silk, and this sheet is cut into tape about $\frac{3}{4}$in wide. This is wrapped round the conductors in the form of a half lap and sufficient layers are applied to give the required electrical strength. Finally a butt joint layer of asbestos tape is wrapped on the outside to give adequate mechanical strength. The coils are then dried in an oven and while still hot are dipped in some form of Bakelizing varnish and moulded to the required dimensions in a hot mould. When cool, the coils are removed from the mould and given a coat of non-tacking paint.

When first made these coils appear to be well moulded and sound quite hard when tapped with a hammer. After a short time in service, however, the insulation swells and becomes puffy. In this condition they are capable of absorbing moisture, so that given the right conditions electrical breakdown can take place.

That this condition can occur is not so surprising when it is remembered that mica, being a non-absorbent material, is difficult to bond with an adhesive at the best of times, but when subjected to pressure the adhesive is squeezed out from between the flakes and reduces the effectiveness of the bond. Furthermore, the varnish used for sticking the mica contains a high percentage of solvent which can only escape by forcing its way between the flakes. Pre-drying the mica sheet before taping is not practicable since the tape becomes too stiff. The Bakelizing varnish which, in theory, should penetrate well into the coil is usually found to be confined only to the outer layer. With such a coil, after a period of service, the only effective resistance to moisture is that offered by the coat of paint.

Various attempts have been made to improve the bonding of the interior of the coil, such as using solventless varnish in making the mica sheets and for brushing in during the process of taping. Apart from objections arising in production, this process has little advantage as, due to the non-absorbent nature of mica, the varnish is only squeezed out again during moulding. For the same reason vacuum impregnation applied to the Bakelizing stage results in little or no improvement.

Apart from the difficulty of bonding mica, it is also found that the mica flakes themselves tend to de-laminate under pressure. For this reason, even if a satisfactory method of bonding mica could be obtained, it is doubtful whether much improvement would result. If we accept the fact that mica is fundamentally unsuitable for moulding, improvements can only be obtained by departing from the use of mica altogether. In this case it is necessary to see what other materials have the required characteristics. Such materials should have good electrical strength, combined with ease of moulding, and should be capable of working under Class B conditions. The latter restricts the choice to glass and asbestos products.

Asbestos and Glass

Like mica, asbestos is a mineral substance and is unique in that it has a fibrous structure. It nearly always contains iron as an impurity and, although by careful processing this can be reduced, the electrical strength is greatly inferior to that of mica. The mineral is also hygroscopic and, since the fibres are smooth and solid, they are not so easily impregnated with varnish. Although asbestos moulds well its lower electrical breakdown strength would make thicker insulation necessary, which is undesirable. Asbestos is now being produced in paper form with a filler and some binding agent. This is claimed to have exceptional purity and good electrical characteristics. Without the binder, as in Class B conditions, the paper would lose its mechanical strength and become brittle.

Glass products are now made in a variety of forms, but that most used in the electrical industry is woven cloth or tape. Glass possesses the necessary electrical properties combined with resistance to high temperature, but several drawbacks make it unsuitable for moulding. Unlike asbestos or cotton, glass does not bed down readily under pressure, so that the thickness of

insulation before pressing has to be carefully controlled. Also, under pressure, the condition of a glass to glass joint occurs and shattering of the glass fibres takes place, leaving weak spots in the insulation. If it were possible to impregnate glass cloth completely with a rubbery type of varnish this factor could be overcome, but successful impregnation of glass cloth is not easy. Apart from the fact that glass fibres are smooth and solid, an oil type lubricant is used in spinning them and this must be removed before impregnation can take place. Even with a perfectly clean and oil-free glass cloth, it is still difficult to get the varnish in between individual fibres. Different types of varnish show a remarkable degree of variation in their ability to "wet" glass cloth (see Fig. 1). Even with the best of these, however, the wetting is not good enough for satisfactory moulding. A woven glass material has been developed recently by Fibreglass, Ltd., which has a texture similar to that of asbestos. This should bed down easily under compression and be more readily wetted by a varnish. It may be that this material will solve many of the problems that hitherto have accompanied the moulding of glass insulation.

Among the composite materials on the market is one made by Insulated Sleevings & Tapes, Ltd., which consists of glass cloth backed with asbestos paper, the whole being fully impregnated with a varnish of the plasticized shellac type. This should be ideal for moulding, since the asbestos paper would act as a cushion between individual layers of glass, preventing shattering, and sufficient varnish should be retained to facilitate moulding. Experiments have shown that, from the point of view of moulding, this material is superior to any containing mica. Even after ageing at elevated temperatures for some considerable time, no sign is seen of puffiness, as occurs when mica is used. To check the electrical characteristics, a number of copper bars were wrapped with the insulation and moulded in the usual way. These were then subjected to an electrical breakdown test with results shown in Table 1. From this it will be seen that the volts per mil for the composite material of glass and asbestos paper were higher than those obtained with mica.

In view of these results, it was decided to have a full-size traction field coil made up, using this composite material. This coil was immersed in water along with a

Table 1

Type of insulation	Volts mil
Mica with Bakelizing varnish	360
Varnished asbestos	116
Varnished glass	128
Glass and asbestos paper with plasticized shellac	448

Table 2

Description	Time for insulation resistance to fall to 1 MΩ
Freshly made coil insulated with mica and bonded with Bakelizing varnish	7 hours
Ditto, removed from machine which had been in service for nine months	10 minutes
Coil insulated with glass and asbestos with plasticized shellac	Greater than 208 hrs.

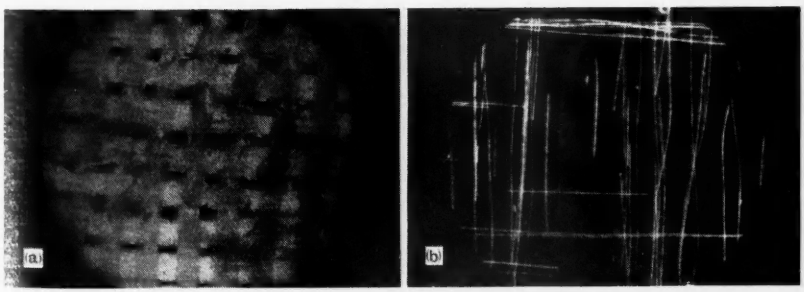


Fig. 1.—Glass cloth after dipping in a varnish having little or no wetting properties (*a*) and after treatment with a varnish having good wetting properties (*b*)

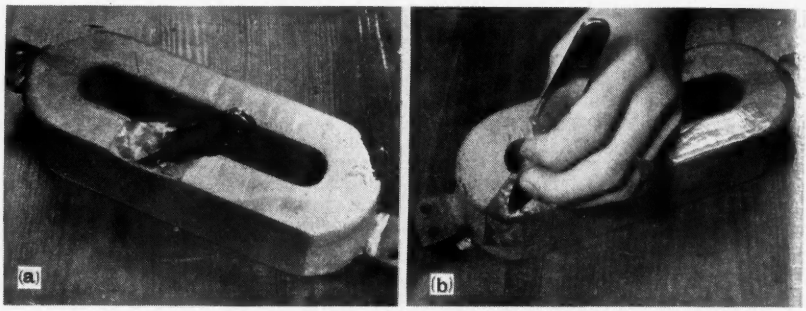


Fig. 2.—Mica insulated coil (*a*) and one insulated with a composite material of glass and asbestos (*b*)

fresh mica insulated coil and one which had been in service for nine months. Measurements were then made of the time taken before the insulation resistance of the coils fell to 1 MΩ, as shown in Table 2.

While these figures illustrate the superiority of the coil insulated with asbestos and glass, a visual examination is necessary to appreciate fully the improvement obtained. In the case of the mica insulated coil it was possible to insert a penknife and cut away the insulation for the purpose of examining the interior. This was quite impossible in the case of the asbestos and glass material, and it could not be opened for examination at all (see Fig. 2).

Moulded traction coils containing mica become baggy after a period of service, due to the continual heating and cooling, combined with vibration. Any substitute for mica, however good electrically, must also have good ageing properties. To check the ageing properties of the composite material of glass and asbestos paper a number of experimental copper bars were moulded with this material and tested beside similar bars insulated with mica.

The bars were heated in an oven at 160 deg C overnight and allowed to cool to ambient temperature during the day. Once a week they were subjected to vibration by being placed loose on a vibrating table. Fig. 3 shows the condition of the bars after a period of this treatment. As can be seen, the mica insulated bar has completely disintegrated, whereas the asbestos and glass composite bar shows no visible change.

Taking into consideration the drawbacks of mica, its high cost, uncertainty of supplies, difficulty of bonding, faults in the flake and the inherent tendency to delaminate under pressure, one may well ask if it is obsolete as an insulating medium. The fact that it is possible with an alternative material to obtain equivalent electrical strength combined with better moulding properties, would indicate that this may be the case. However, recent developments have been made in the processing of mica which may overcome some of the difficulties described.

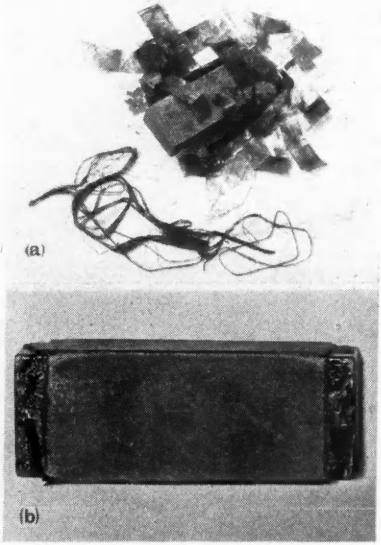


Fig. 3.—Comparison of mica insulated (*a*) and glass and asbestos insulated (*b*) copper bars after ageing tests

In one of these, the mica flakes, by chemical and mechanical treatment, are reduced to a pulp similar to that used in paper-making. In fact, it is produced on a similar machine to that used in making paper. By this process, the mica can be produced in rolls of indefinite length and having a uniform thickness. In this state, the material has poor electrical properties and practically no mechanical strength. However, when treated with varnishes and bonded to bases of paper and glass, it possesses dielectric strength superior to a material built up from natural mica flakes.

This process of producing mica sheet has a number of advantages over the conventional method of using mica flake. As the mica is reduced to extremely small dimensions during the process, faults in the mica flake such as pinholes and tears are of no consequence. Also, the mica is reduced to its minimum thickness and no further delamination can take place. Again, the mica used can be of a size which has little commercial value at the present time, this fact tending to affect the cost of the extra processes so that its cost is comparable with ordinary mica sheet. As the material is similar to a porous paper more efficient wetting with varnish can be obtained, which should result in superior moulding properties.

While it is at present too early to say what the future of this material may be, it is possible that this new process will enable mica to continue to be used as an insulation, and at the same time achieve satisfactory bonding with moulded coils. As said at the beginning of this article, so firmly established has mica become in the minds of engineers that the psychological and sales effect of retaining mica makes this very desirable.

Lighting of the Old Bailey

THE Central Criminal Court, known as the Old Bailey, has been restored after being damaged at least three times during World War II. Three of the permanent Courts, including a new one (Court No. 5) have been reopened, and the remaining work of restoration and improving the building will probably be finished by the end of the year. Many improvements have been introduced in the building, particularly in heating and ventilation.

The main lighting in the recently constructed No. 5 Court is provided by three special "Ediswan" ceiling fittings, 42in in diameter and 15in deep and made of metal, bronze cellulosed and glazed with diffusing glass. Each fitting weighs approximately 120 lb. Nine lamps are used per fitting to provide a high level of diffused light in the well of the court. The units are fitted with precision type raising and lowering gear to ensure exact positioning in the cast brass ring fixed on the plaster moulding in the ceiling.

The whole of the work has been carried out by the Corporation of London under the direction of the city surveyor, Mr. George Holliday, F.R.I.C.S. The consulting engineers for the work were Messrs. W. J. Perkins & Partners. The main contractors were Higgs & Hill, Ltd., and the electrical sub-contractors, H. J. Cash & Co., Ltd.

The new No. 5 Court at the Old Bailey is illuminated by three special "Ediswan" lighting fittings

Pumped Storage

The Schluchsee Scheme

TECHNICAL features of Europe's largest and latest hydro-electric development to incorporate pumped storage are given by Mr. K. A. Scholz in the *Engineering Journal*, published by the Engineering Institute of Canada. Situated in the upper Rhine district of south-west Germany, the Schluchsee undertaking of the Rhenish Westphalian Electricity Co. is connected to steam and run-of-river plants on the lower Rhine and the Ruhr and to the Austrian and Swiss Alps via the R.W.E. 220 kV grid (to be 400 kV later), which covers an area of 400 sq miles.

The installed capacity of the three Schluchsee stations in series is 407,000 kW with a yearly output at present of 550 million kWh, of which 287 million comes from the natural run-off of the watershed and 260 million is the result of off-peak pumping of tail water from the Rhine back to the main reservoir, which has a usable storage area of 88,000 acre feet with an annual precipitation of 70 in.

Increased Capacity

Completion of projected supplementary water supplies will raise the total average yearly output to 750 million kWh, giving a potential utilization at maximum capacity of 1,840 hr per annum. About 1·75 kWh is used off-peak by the pumps to produce each kWh supplied to peaks, so that 450 million kWh of pumped power is converted to 260 million kWh of annual peak load energy.

Capital investment up to now is estimated at $50 million (216 DM) and the capital cost per rated kW is about $125 (530 DM). The output of the Schluchsee scheme forms 1 per cent of the total for the West German Federal Republic and 6·5 per cent of the hydro energy, but this represents 2 per cent of the total installed kW capacity.

Five solid concrete gravity dams have so far been built. Each of the three stations contains four Francis turbines, vertical (333·3 r.p.m.) in the first two and horizontal (250 r.p.m.) in the third; the 10·5 kV alternator of each set acts as a synchronous motor when coupled by a hydraulic clutch to a two-stage pump rated at 325 cu ft/sec. Before engaging the clutch the pump is run up to the speed of the generator motor by a small impulse turbine and only 3 min is taken for the change-over.

At the first station, the Haeusern, the 48,500 h.p. turbines have each a maximum discharge of 780 cu ft/sec at a head of 630ft and the alternators have individual capacities of 32,000 kVA at 0·7 power factor. The pumps require 22,000 kW at 0·7 power factor. Operation of all three stations is carried out automatically in the Haeusern control room with provision for hand operation in emergencies. A 740 h.p. set supplies the auxiliaries of this and the two other plants.

The layout of the Witznau station is generally similar, but the turbines are of 74,000 h.p. each at 710ft head and have a maximum discharge of 1,050 cu ft/sec. The alternators are 55,000 kVA machines at 0·8 p.f. and the motors 32,000 kW.

The turbines of the Waldshut plant (commissioned last year) are rated at 59,000 h.p. each at 470ft head and 1,240 cu ft/sec. The alternators have outputs of 44,000 kVA at 0·8 p.f. and as motors take 18,000 kW. The yearly outputs of the stations in millions of kWh are: Haeusern, 41 from natural run off, 99 from pumped storage, total 140; Witznau, 140 and 110, making 250 total; Waldshut, 106 and 54, making 160. On completion of the scheme the total outputs of the two last stations will become 380 and 230 million kWh.

Zagreb Fair Exhibits

AT the Zagreb Fair (12th to 27th September), exhibits from the engine export divisions of the Brush Group (Associated British Oil Engines (Export), Ltd., and National Oil Engines (Export), Ltd.), will be shown by B.S.E. Merchants, the companies' agents in Yugoslavia. The engine exhibits will be Petter B2M, PA2C and AV2 and McLaren " Brabo " 6 kW generating set. Also on show will be photographic panels illustrating applications of National and Mirrlees engines in marine, industrial and generating installations.

The New Transport Act

Summary of Main Provisions

By GRAHAM SAVILLE

MOST electrical concerns will be aware that the Transport Act, 1953, contains many provisions of considerable importance to them. While the main purpose of the Act is to transfer the nationalized road transport undertaking to private enterprise, the Act also contains provisions dealing with various other aspects of transport.

One of these aspects, of considerable importance, is the introduction of a transport levy, the purpose of which is to create a transport fund. Practically all vehicles operated by electrical firms will come within the scope of the levy, as it covers most types of vehicles of over 30 cwt unladen weight.

Purpose and Extent of Levy

The transport fund is to be used to pay for the expenses of the Road Haulage Disposal Board, to compensate the British Transport Commission for losses arising from the sale of its road haulage undertaking, to pay a million pounds to the Commission for the disturbance caused by the sale of the undertaking and also to cover other sundry items, such as compensation to employees. The levy will operate from 1st January, 1954, and the initial amount will be 13s 6d for each quarter ton of unladen weight. There are to be, in addition, other charges applying to vehicles drawing trailers and also to tractors.

The Act does not lay down any specific period over which the levy is to continue; this will largely be at the discretion of the Minister of Transport according to the requirements of the transport fund.

The new Act introduces many changes with regard to goods vehicle carriers' licences. The main purpose of these changes will be to instruct the licensing authorities, when exercising their discretion to grant or refuse applications for licences, to have greater regard for the interests of the public generally. This means that persons requiring transport will, in the main, have preference over those providing transport.

Emphasis has also been laid on the use of containers which will enable goods to be carried without transhipment.

When considering whether facilities are suitable, the licensing authorities must have regard to many factors, including the cost of the transport.

One of the major factors restricting the use of carriers' vehicles for some time has been the 25-mile restriction imposed on a great number of vehicles by the Transport Act, 1947. It was thought in some quarters that this restriction should be rescinded; the Transport Act, 1953, provides for its abolition at the end of 1954.

Electrical concerns will not be intimately concerned with the whole of the machinery which is to be set up for transferring the British Transport Commission's road transport undertaking to private enterprise, but there are one or two factors of which they should take note.

Method of Disposal

The body controlling the disposal has been set up and is called "The Road Haulage Disposal Board." Four methods have been laid down for the disposal of the Road Haulage Executive's undertaking and one of these is of particular importance: the sale of transport units.

Under this method, the British Transport Commission will invite from time to time, by means of public notice, tenders for the purchase of one or more specified motor vehicles and such other property as may be specified. The object behind the sale of these units is to enable purchasers to engage without delay in the carriage of goods by road for hire or reward.

Particular attention has also been given to the necessity for encouraging smaller operators to enter or re-enter the haulage industry. In order to put this policy into

effect, it is provided that no transport unit shall, without the approval of the Minister of Transport, include more than 50 motor vehicles, or motor vehicles the aggregate weight of which, unladen, exceeds 200 tons.

At the present time there are a number of restrictions which prevent persons engaging in the road haulage industry. The most important of these restrictions is the difficulty in obtaining a carrier's licence to carry for hire or reward. To meet this point, the Act provides that purchasers of transport units shall have the right to special "A" licences which will enable operators to exceed the 25-mile limit laid down by the Transport Act, 1947, and the licence will be valid for a period of five years.

There is one point with regard to this right to a special "A" licence which should be noted. If the vehicles are to be used from some other base than that used by the British Transport Commission when operating the vehicles and the licensing authority is of the opinion that the vehicles cannot serve substantially the same areas as those which were previously served, a licence may be refused.

Other methods laid down in the Act for the disposal of the vehicles and property of the Road Haulage Executive are by the transfer of transport units to companies under the direct or indirect control of the British Transport Commission; by the transfer to companies under the British Transport Commission's control with the object of subsequently selling the shares; and by the disposal of "oddments" at the discretion of the Minister of Transport.

As already mentioned, in addition to the features of the Act which cover road transport, other matters are dealt with. As regards the railways, the Act is not specific in laying down the manner in which they should be reorganized. It does, however, place the onus on the British Transport Commission of preparing a scheme covering the decentralization of railways and the new arrangements will be on a regional basis.

Transport Charges

One of the most important changes set out in the Transport Act concerns transport charges. Under the earlier Transport Act, the British Transport Commission was required to prepare draft schemes of charges covering most aspects of their operations. These schemes, in respect of goods charges, provided that fixed or standard charges should be laid down. Now the Commission has only to provide for maximum charges and it will thus have a much greater freedom in quoting rates.

Such points as the publication of rates have been amended and the Commission has now only to publish its maximum charges. The necessity to make equal charges and to avoid creating undue preference has also been rescinded.

It has always been a matter of some concern to the Commission that it has been unable to adjust its charges quickly to rising costs. This has now been dealt with in that, subject to certain provisions, the Commission can raise its charges by not more than 10 per cent to meet increases in costs.

SOUTH AFRICAN NEWS

From Our Cape Town Correspondent

IT is now anticipated that the first 60 MW set of the Electricity Supply Commission's new Taaibos power station will be in service in September, 1954, and that the remaining six similar sets will come into operation at intervals of six months, so bringing the station to its planned capacity of 420 MW. These Parsons turbo-generators will be the largest units in South Africa. This pithead power station is being built in the Coalbrook region of the Orange Free State on a site of nearly 900 acres. Coal will be taken from the pithead to the coal staith and then into the station's bunkers along three conveyor belts with an aggregate length of 5,200ft. Coal will be pulverized in "E" type mills, the first of their kind to be installed in a South African power station. There will be seven boilers of the bi-drum type, much of the component material for which will be fabricated in the Babcock & Wilcox works at Vereeniging.

For interconnection with the Vaal power station, two groups of single-phase transformers are to be used, each group with a capacity of 60,000 kVA and a ratio of 132/88 kV. Air blast cooling is to be used and tertiary windings on transformers will supply the 3·3 kV station auxiliary services.

Barlow Whitney (S.A.) (Pty.), Ltd., Johannesburg, are now making immersion heaters of a type which was previously imported from Britain. The element is still being imported from Metropolitan-Vickers in England, but apart from this the entire heater is being made in South Africa to Barlow Whitney design. They are now available in 1 kW to 6 kW sizes and are sold with a three-year guarantee.

VIEWS on the NEWS

By REFLECTOR

FARMERS often complain about the high cost of electricity supply but this usually relates to the initial capital cost, for most of the Electricity Boards offer them quite attractive tariffs. The Merseyside and North Wales Board is introducing a new tariff and although it was said at a meeting of the area Consultative Council that this would mean an increase of 20 per cent to some farmers, industrial members of the Council thought it too generous. One of them went so far as to say: "There cannot be one law for the rich farmer and another for the poor industrialist." Nor, I suppose, for the poor farmer and rich industrialist, unless some form of means test is instituted.

* * *

It looks as though the North of Scotland Hydro-Electric Board is really exasperated at the constant accusation that it is providing electricity to England. In a letter to the *Scotsman*, Mr. G. D. Banks, the Board's information officer says:—

> "Not a drop of water goes to the making of a single unit of Highland electricity destined for English consumption. This simple fact has been stated over and over again by the Board, but with a vehemence and dogmatism exceeding their knowledge an occasional critic bobs up to voice disbelief. But a fact is a fact and the Board can do no more than to state it."

* * *

A frequent argument in favour of the open coal fire is that it assists in ventilating a room whereas an electric fire, needing no draught, causes little air movement. However this may be, a writer in the *British Medical Journal* tells how, during a heavy fog, an old lady suffering from bronchitis sealed up the fireplace and windows of her room and switched on an electric radiator before retiring. The writer, Professor Guy Crowden, commends this lady's example to those suffering from respiratory ailments as a means of keeping out fog. I think that in a small room the atmosphere would become somewhat oppressive in these circumstances. Would not an electric fan-heater intake, possibly with some form of filter, be effective?

* * *

A "cosmic therapist" (one of 30 or more in Britain) has been discovered by the *Sunday Pictorial*. This paper says that "men and women who leave their blood spots at a spacious flat . . . pay up to £5 a month for their ailments to be treated in their absence by a machine." "Strange electrical instruments very much like accumulators fitted with radio-like dials" are employed. The method is very simple: the patient leaves his blood spot, the practitioner gets a diagnosis and then chooses one of his 4,000 classified cosmic waves and treats the spot. Every ailment has a numbered wave-form; worry is related to wave-form 10853 and "hopelessness," "jealousy," "frustration" and "unrequited love" are among the subjects treated. Why should the *Pictorial* writer seem a little sceptical?

* * *

At Ripley (Derbyshire) the Lighting Committee has been unable to decide between two candidates for the chairmanship. As a result, it is said, the Committee, appointed some weeks ago, cannot do any work. It is comforting to learn that in spite of this the street lights are still operating, which is perhaps not surprising.

* * *

Those fish again! The Irish Fisheries Trust is reported by the *Belfast Telegraph* to be catching fish for transfer to other waters by means of a mobile (German) machine which stuns the fish electrically and draws them by a magnet into a net. But what about non-ferrous fish?

PERSONAL and SOCIAL

News of Men and Women of the Industry

OVER a hundred guests, including many leading personalities of British business and industry, attended an informal cocktail party held at the Savoy Hotel, London, on 14th August, to welcome **Mr. Guy J. Coffey,** president of the Chicago Pneumatic Tool Co. of New York, and chairman of the Consolidated Pneumatic Tool Co., Ltd., London, who arrived in the *Queen Elizabeth,* accompanied by Mrs. Coffey, earlier in the week. He is making a six weeks' business trip embracing visits to the company's factories at Fraserburgh and Aberdeen, and branch offices on the Continent.

Mr. W. F. B. Baker, D.F.H., A.M.I.E.E., has been appointed manager of the Technical and Design Departments of Solenoids & Regulators, Ltd. Mr. Baker received his technical education at Faraday House, and subsequently held appointments with the General Electric Co., Ltd., Tube Investments, Ltd., and P. H. Jackson & Co., Ltd. During the war he served as a lieutenant in the Electrical Branch of the R.N.V.R., and until recently held the position of chief engineer with the Hockley Chemical Co., Ltd. Mr. Baker is a member of the Council of the Institute of Metal Finishing and was chairman of the Midlands Branch in 1952-53.

Dr. J. L. Robinson, Minister of Industries and Labour, Alberta, and **Mr. R. A. McMullen,** Agent-General for Alberta, visited the Rugby Works of the British Thomson-Houston Co., Ltd., on 17th August, when they toured the fabrication, turbine, gear, large transformer, and heavy plant factories, and also inspected in considerable detail the B.T.H. apprentice hostel (Cotton House).

Left to right: **Mr. R. A. McMullen (Agent-General for Alberta), Mr. L. J. Davies (Director of Research and Education, B.T.H.), Mr. H. G. McHaffie (manager for Canada, B.T.H. Export Co.), Dr. J. L. Robinson (Minister of Industries and Labour, Alberta Government), Mr. C. K. Bird (manager, Turbine Sales, B.T.H.), Mr. H. Jack (director, B.T.H.), and Mr. W. S. Steel (sales director, B.T.H.)**

Mr. P. T. Wood, manager of the Leek and Cheadle (Staffs) District of the Midlands Electricity Board, is taking up an appointment with the Southern Electricity Board. He will be succeeded on 1st September by **Mr. J. A. P. Firth,** manager of the Stoke South-East District; **Mr. J. E. France** will move from Stoke South-West to Newcastle (Staffs), and the present manager of the latter district, **Mr. F. R. Ward,** will become manager of the Stoke South-West and South East Districts which are being combined under the title Stoke South.

Mr. Thomas Potts, who has been manager of the Doncaster Corporation transport undertaking since 1920, has recently retired. Mr. Potts joined the Electricity and Transport Department of the Corporation in 1904 and became transport manager when the department was divided into two separate units.

Mr. W. E. Miller, M.A.(Cantab.), has been re-elected president of the British Institution of Radio Engineers for a second term of office. Mr. Miller is editor of the *Wireless & Electrical Trader.* He was born in London in 1902 and was educated at Walter St. John's School, Battersea, and Peterhouse, Cambridge. After a year in the Tests Department of the Cambridge Instrument Co. he joined *Experimental Wireless and Wireless Engineer* as technical editorial assistant in 1925. The following year he became technical editor of the *Wireless Trader* and was appointed to his present position in 19[illegible]. He has been a member of the British Institution of Radio Engineers for over twenty years, having served on [illegible] of the Institution's

standing committees and on the General Council. He was chairman of the Council from 1946 to 1948 when he was elected a vice-president.

Mr. E. A. Roden is retiring from the position of secretary of Nash-Kelvinator, Ltd., at the end of September, after twenty-six years' service. He will, however, continue as a director. His place as secretary will be taken by **Mr. M. Maurice,** a newly elected member of the board, who has been closely associated with the Kelvinator organization for several years.

In our last issue we reported the resignation of **Mr. A. F. Brown** from the position of sales manager of British Electric Lamps, Ltd. The company, which supplied the information, now informs us that it was in error in ascribing Mr. Brown's resignation to " health reasons." Mr. Brown tells us that he is in quite good health and is immediately available for any new appointment.

Mr. S. C. Furbank, general manager of the Trafalgar Engineering Co., has resigned after thirty-nine years' service with the firm which he joined when he was fifteen. He was appointed works manager in 1928 and became general manager seven years later.

Mr. J. Whitmill has been appointed by Everett, Edgcumbe & Co., Ltd., as applications engineer for London and the Home Counties. Mr. Whitmill has been with the company for about twenty-eight years. He will have his headquarters at the Colindale Works.

Mr. R. F. Baldwin, F.Inst.Pet., Associate I.E.E., has been appointed general manager of the Electrical Department of W. B. Dick & Co., Ltd.

Mr. F. Spicer has been appointed general manager of Rushtons (Leeds), Ltd.

Mr. and Mrs. W. E. Warrilow, 24, Bath Hill Court, Bournemouth, celebrated their golden wedding on 25th August.

Mr. F. K. Haddon, radio representative attached to the Newcastle Branch of Philips Electrical, Ltd., recently completed twenty-five years' service with the company. To mark the occasion, a function was held at Tilley's Restaurant, Newcastle, at which Mr. L. A. Higson, Newcastle Branch manager, Mr. H. M. Thorne, sales manager, radio and television group, were present, in addition to several of Mr. Haddon's immediate colleagues. Mr. A. L. Sutherland, commercial manager, radio and television group, presented a cheque to Mr. Haddon on behalf of the company.

Mr. H. Norman G. Allen has been re-elected chairman of the Council of the British Internal Combustion Engine Research Association for the current year.

OBITUARY

Mr. J. Williamson.—The death is reported of Mr. James Williamson, C.B.E., a consulting engineer who specialized in hydro-electric work. After service in the 1914-18 war, Mr. Williamson joined Sir Alexander Gibb & Partners and took charge of the Galloway water-power scheme. Later he became a director and chief engineer of Sir William Arrol & Co. He was a member of the Cooper Committee which reported upon Scottish water power and he did much work for the North of Scotland Board, being concerned with many of the Board's major schemes.

Professor S. Parker Smith.—We regret to learn that Professor Stanley Parker Smith, C.B.E., D.Sc., M.I.E.E., A.M.I.C.E., died on 21st August, at Perth, after an operation. Dr. Parker Smith was born at Grantham in 1884 and was educated at Armstrong College, Newcastle, and the Technische Hochschule, Carlsruhe, Germany. In 1907 he became an assistant designer at the Siemens works, Stafford, and two years later joined the Witton Works of the General Electric Co., Ltd., as chief designer. He was appointed lecturer and assistant professor at the City and Guilds College in 1912 under Professor T. Mather, and in 1923 he became professor of electrical engineering at the Royal Technical College, Glasgow, a position from which he retired in 1948. He was then invited by the late Sir Edward McColl, deputy chairman and chief executive officer of the North of Scotland Hydro-Electric Board, to found and run the Board's staff college, and he retired from this position last year. Dr. Parker Smith contributed an article on the Board's training scheme to the *Electrical Review* of 5th March, 1948. This was one of several articles which he wrote for this journal over a long period, some of them dealing with domestic electrification, a subject in which he took a practical interest. His published work included books on the " Electrical Equipment of Automobiles " and " Problems in Electrical Engineering " as well as educational manuals. Dr. Parker Smith was vice-president of the I.E.E. in 1942. He leaves a widow, a son and a daughter to whom we extend our sympathy.

The late Professor S. Parker Smith

Mr. Edward Bernard Bull, whose death has occurred in London, lived at Whitley Bay (Northumberland), and had been managing director of Welwyn Electrical Laboratories, Ltd.

Electrical Technology in Medicine

By B. M. WHEATLEY, Ph.D., A.Inst.P.*

International Developments in Radiology

THE growing importance of the part which engineering plays in radiological medicine was indicated by the introduction of a Technology Section in the International Congress of Radiology at its 7th meeting in Copenhagen during July.† The Congress was opened in the presence of King Frederick IX and was attended by 3,500 members from 56 countries. The organization of the meeting, which could easily have been confusing, was so well handled by our Danish hosts that not only did the meetings run smoothly, but also the Congress proved to be a most enjoyable social occasion. Since 500 papers were read in the course of a week it was necessary to hold simultaneous meetings in different halls of the university. Translations of the more important papers were broadcast over a short-range system and much of the benefit of the meetings was owed to the interpreters who, incidentally, even dealt with Russian at short notice.

For convenience the Congress meetings were divided into five sections. Naturally the two largest sections were concerned with therapy and diagnosis and the other three with physics, biology and technology. This article will attempt to outline some of the work concerned with electrical engineering which was presented in the physics and technology sections. The main groups of technical papers were concerned with electrical amplification of the diagnostic image, the development of high voltage diagnostic apparatus, photoelectric exposure control, high speed cineradiography, the design of high voltage particle accelerators and of rotation therapy equipment.

Image Amplifiers

The biologist's problem of studying living organisms with X-rays is complicated by the damage caused by the radiation, and the corresponding clinical problem of radiodiagnosis is made more difficult by the radiation hazards to the patient and operator. When the image is visually examined on a fluorescent screen the limit of resolution is set by the response of the human eye. Several authors presented details of image amplifiers in which the conventional fluoroscopic methods are replaced by a photo-electric detector followed by an electrostatic lens system giving enormous gains in brightness. None of the devices described have reached the theoretical limit of efficiency, but already they are working with gains of over a thousand in brightness. One author described an X-ray microscope for examining internal movements in small organisms. This apparatus consisted of an X-ray tube, which could be operated at between 4 kV and 200 kV, mounted so that a very narrow beam of radiation could scan the specimen. The transmitted radiation was revealed electronically so that the dose to the specimen was lower than the corresponding dose with a conventional apparatus by a factor of a million.

X-Ray Cinefilm

Besides these developments in image presentation several other engineering advances in the design of diagnostic equipment were reported. It is of great service in some investigations if a high speed X-ray cinefilm can be taken to record the movements of internal organs, such as the heart. Quick acting shutters cannot be made for penetrating radiation even if X-ray tubes could be continuously loaded. As a result it has been necessary to develop high speed switches for applying h.v. to the tube for periods of the order of 10 milliseconds. At least two devices were described in which triode circuits had been developed to switch on a load of several kVA for periods as short as a few milliseconds.

For single shot exposures a rather different problem occurs, since the mean

* Royal Cancer Hospital, London.

† *Electrical Review*, 7th August, 1953, p. 307.

load is much less than the instantaneous level and it is uneconomic to run 40 kVA mains wiring for occasional use. This problem has been solved by designing a motor generator set needing a mains input of only 4 kVA but capable of an instantaneous output of 125 kV at 500 mA. The high output is achieved by means of kinetic energy stored in the machine rotor.

The exposure of X-ray films naturally affects the quality of the recorded image, and in order to obtain films of satisfactory quality for some chest examinations it is useful to control the exposure time automatically. This can be done by operating the contactors of the X-ray plant through a trigger relay, operated by a photocell, which is illuminated proportionally to the radiation on the film. Several papers described the criteria for maintaining proportionality of response between the film and the controlling circuit without the need of corrections for kV and patient thickness.

The topics discussed in the papers devoted to the engineering of therapy equipment were mainly concerned with the design of apparatus for deep therapy. Two classes of apparatus were discussed: those which relied on the properties of high energy radiation in order to concentrate the X-ray dose at a depth, and those which relied on rotation of the beam to cause a focusing effect within the patient. Of the high energy accelerators it is claimed that the linear accelerator is the most economical to operate. Two British versions were described in which electrons are accelerated to their target along a corrugated waveguide. One type, operating at 8 MeV, has a fixed tube, from which the X-ray beam can be brought through a rotating head. The other type, operating at 4 MeV, is smaller and can be mounted as a mobile unit. Several betatrons were described, the novel features being the successful extraction of the electron beam through their windows in the vacuum chamber, and the development of an industrial apparatus with two adjacent targets for taking stereoradiographs of thick specimens.

One of the outstanding features of the Congress was the interest in rotation technique now developing in all countries. These methods, if properly used, can deliver large doses to deep seated tumours without damaging the superficial tissues. The problem of design is largely an electrical one, since heavy components must be moved at predetermined speeds, and often a servo linkage is necessary to co-ordinate simultaneous movements. The engineering techniques are in fact similar to those in automatic machine tool design, but their application to medical apparatus is novel and a new potential market is indicated for constant speed circuits, synchronous linkages, and the other devices common to precision moving machinery.

It appears that the medical X-ray industry is an expanding one with a ready market for efficient apparatus. In order to improve the performance of the apparatus the design is becoming much more complex both mechanically and electrically. The papers at Copenhagen served to show that the challenge has been met by the engineers of several countries, and when the next Congress meets in Mexico in 1956 some of the developments should have served a constructive role in the diagnosis and treatment of disease.

Electric Micromanipulator

A NEW type of electric micromanipulator for experimentation with living cells, or other objects under high magnification, is described in the July issue of the American *Review of Scientific Instruments* by V. Bush (Carnegie Institution of Washington, Washington, D.C.), W. R. Duryee (National Cancer Institute, U.S. Public Health Service, Bethesda, Maryland), and J. A. Hastings (Hastings Laboratories, Bass River, Massachusetts).

The apparatus described consists of four electrically operated toolholders, each suspended under spring loading by thermal expansion wires. In turn, these are controlled by variable transformers operated by two "joysticks." The electric switches determine which toolholder will be influenced by either joystick.

Ratio control transformers in the 110 V line-operated power unit allow an operator precise, normalized, three-dimensional control of the microtools, viewed under any magnification of the compound microscope. In addition to the joystick control covering the range of 0·5 to 400 microns, each toolholder has three sets of mechanical controls to allow coarser adjustment for the range of 0·1 to 10 mm. Magnetic chucks and other conveniences for the observer have also been provided.

Electricians' Strike

Statements by E.T.U. and N.F.E.A.

AT a Press conference in London on Monday evening this week Mr. Walter Stevens, general secretary of the Electrical Trades Union, made the following statement relating to the Union's dispute with the National Federated Electrical Association and the consequent strike action which started on that day.

An application for a substantial increase in wages for its members was made by the Union to the Association on 1st February last, and this was rejected during March. Subsequent mass meetings of the E.T.U. members throughout the country showed that strike action was favoured, and on 23rd July it was officially decided to call strikes at certain selected "sites" on 24th August.

The employers were immediately informed of the decision, but apart from a formal acknowledgment of the Union's letter, there had been no further communication from them. The Union had again written to the N.F.E.A. on the first day of the strike, last Monday, confirming that the decision upon strike action was being put into effect.

As a first move ten "sites" had been chosen for strike action, and at the time of the conference Mr. Stevens had received confirmation that the action had been taken at the following seven "sites": Leyland motor works, Lancashire (160 men); Ministry of Supply Atomic Establishment, Capenhurst (150); Associated Ethyl oil refinery, Ellesmere Port (450); Austin motor works extension, Longbridge (76); Atomic Research Establishment, Aldermaston (134); the Coryton oil refinery (60) and London Airport (74).

The other three "sites" for which confirmation of strike action was still to come at the time of the conference were: the new Port Talbot steelworks, the Isle of Grain oil refinery and the Trostre steel works.

Mr. Stevens explained that the strike policy of the Union was one of "guerilla warfare," in that, if necessary, the strike would be extended in groups of "sites" selected by Union area officials from time to time. It was likely that action would be taken at the next batch of "sites" on Thursday this week.

Mr. Stevens said that the Union had made no move towards arbitration in this dispute, and he was doubtful about the employers' intentions in this respect. For the time being, at any rate, E.T.U. members employed by non-federated contractors were not being called on to strike.

The terms of the Union's claim—"a substantial increase in wages"—was not more clearly defined, but it appears that the Union's contention is that in respect of the index figure for the increase of the cost of living electricians' rates of pay should now be 3s 9½d/hour in the provinces and 4s 2d in London. The present rates are 3s 7d in the provinces and 4s 0d in London.

N.F.E.A. Statement

Mr. L. C. Penwill, director and secretary of the N.F.E.A., presented a statement to the Press on Tuesday giving the Association's account of the circumstances leading to the dispute, and answered questions.

The statement showed that the Association had considered the Union's claim for a "substantial increase" on the basis of the rise in the cost of living and had rejected it. The Association offered the Union the "facility of discussion" to enable it to explain the reasons for its decision. This offer had been ignored and in a letter dated 23rd July, the Union had stated that failing an offer to increase wages official strike action would be sanctioned on contracts being carried out by N.F.E.A. members in various parts of the country.

In the light of this, Mr. Penwill said, it was difficult to understand why Mr. Stevens had stated that the Association had refused to discuss the matter. Moreover, the Association had no knowledge of any incident in which it had said that it would refuse to attend before the Industrial Disputes Tribunal.

It was pointed out that the hourly rate for electricians had increased by 43·3 per cent since April, 1946, while the cost of living had risen by 36·8 per cent. The "weekly wage packet" had increased by 37·7 per cent (without taking into consideration the 2d per hour increase last November), against a general rise in the Ministry of Labour wage index of 32 per cent. The standard rate for a 44-hour week was £8 16s in London and £7 17s 8d in the Provinces, but the actual weekly payment averaged £9 5s and the average earnings of the members on strike were substantially higher.

Mr. Penwill said that the N.F.E.A. was still willing to discuss the subject, but still could not accede to an advance on a cost-of-living basis. If, however, the E.T.U. could show that the Association's figures were wrong, or if it could produce other evidence in favour of an increase, the Association was ready to meet the Union representatives. Also the N.F.E.A. was willing to consider arbitration, although it did not think that there was any matter for arbitration.

was up to the Union, not the Association, to seek arbitration. Mr. Penwill stressed that there must be a return to work before there could be any discussion. The Association's members would not be intimated by the "guerilla warfare" instituted by the Union.

On Tuesday afternoon about 200 electricians employed at Olympia and Earls Court, London, intended to cease work. Those at Olympia are engaged in preparing stands for the Engineering, Marine and Welding Exhibition due to open on 3rd September, and the men at Earls Court are similarly engaged in connection with the Radio Exhibition opening on 2nd September. In both cases the men concerned are employed by outside contractors, not the managements of the halls.

It was reported on Tuesday that the Ministry of Labour intended to meet representatives of the two parties to the dispute in an endeavour to arrange joint talks.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Houses for Supply Workers

WITH what pleasant surprise must scores of readers of your editorial welcome the news that at last some local authorities are beginning to realize that we poor mortals in the supply industry should have some sort of abode, even though foreign to some areas by virtue of initiative.

I, like many more of your readers, have answered advertisements appearing in the *Review* and have been selected for the particular position, but when the accommodation question arose along came the cold water douche—"sorry we cannot help but will write in support of your application."

The majority of local authorities seem to give preference to applicants engaged in the export trades, but will they explain where exports would be without the most important feature of the export drive—electrical energy?

Hardly anyone with ambition wants to see the B.E.A. or the Area Boards bring into general practice the "tied house," but even this would raise the hopes of some and encourage some moves and maybe promotion.

"AMBITIOUS JOINTER."

"Are Qualifications Necessary?"

QUALIFICATIONS can hardly be called "necessary," but a good qualification (e.g., corporate membership of one of the senior institutions) is a useful label which generally indicates that a certain standard of education, training and experience has been attained. It can be of assistance to employers in considering applications, but it is of course important to bear in mind that the lack of this label does not necessarily mean that the bottle does not contain the genuine article.

Unfortunately the qualification currency has in recent years been debased by the many new societies which have sprung up, so that almost anyone with some engineering knowledge can now pay a subscription and put some letters after his name.

I think every engineer who can do so should become a corporate member of the appropriate institution, thereby availing himself of the facilities offered—particularly the pooling of engineering knowledge and experience—and helping to maintain the status of the profession.

The term "engineer" is so generally applied that we cannot emulate the architects and the medical profession and restrict its use to chartered engineers.

"B.SC.(ENG.), A.M.I.MECH.E., A.M.I.E.E."

Lamps for Street Lighting

MR. STANIFORTH having put the case for the h.p.m.v. lamp, may I venture a few observations. From the purely visual point of view there can be no question that fluorescent street lighting leads on the two main counts, minimum of glare and the most natural colour. Capital cost is higher than that of either tungsten, sodium or h.p.m.v., but I

question the statement that it is uneconomical. Initial cost is not everything and it can easily be shown that, on the contrary, for equivalent lighting levels, fluorescent lighting is, in the long run, by far the most economical.

In great Britain we have one tube, the 5ft 80 W "White (3,500°K)," with an average through life output of 4,000 lumens and a life of 5,000 hours. Two of these tubes have approximately the same light output as the 250 W h.p.m.v. lamp (2,500 hours' life) and the 500 W tungsten lamp (1,000 hours' life). The running costs per 1,000 hours on the basis of 1d/kWh with replacements at 80 per cent of the expected life to avoid premature failures and allowing 10 per cent for control gear losses where applicable are as follows:

(a) TUNGSTEN.

$$\frac{1{,}000}{1{,}000 \text{ hrs. life} \times 0{\cdot}8} \times 10\text{s} = 12\text{s } 6\text{d}$$
$$+ (500 \times 1\text{d})$$
$$= £2\ 14\text{s } 2\text{d per } 1{,}000 \text{ hrs.}$$

(b) H.P.M.V.

$$\frac{1{,}000}{2{,}500 \times 0{\cdot}8} \times 54\text{s} = 27\text{s}$$
$$+ [(250 \times 1\text{d}) + 10 \text{ per cent}]$$
$$= £2\ 9\text{s } 11\text{d per } 1{,}000 \text{ hrs.}$$

(c) SODIUM.

$$\frac{1{,}000}{3{,}000 \times 0{\cdot}8} \times 74\text{s } 6\text{d} = 31\text{s}$$
$$+ [(140 \times 1\text{d}) + 10 \text{ per cent}]$$
$$= £2\ 3\text{s } 10\text{d per } 1{,}000 \text{ hrs.}$$

(d) FLUORESCENT.

$$\frac{2 \times 1{,}000}{5{,}000 \times 0{\cdot}8} \times 15\text{s } 2\tfrac{1}{2}\text{d} = 7\text{s } 7\text{d}$$
$$+ [(160 \times 1\text{d}) + 10 \text{ per cent}]$$
$$= £1\ 2\text{s } 3\text{d per } 1{,}000 \text{ hrs.}$$

Fluorescent lighting shows a saving of 21s 7d per 1,000 hours over its nearest rival, sodium, or for all night lighting (4,000 hours per annum) £4 6s 4d per annum.

The long length of the fluorescent tube necessitates a more expensive housing but it is not beyond the capabilities of manufacturers to produce a fluorescent lamp for street lighting for under £20. One manufacturer I know has a design for a four-tube fitting which will be offered at between £15 and £20 in the near future. This makes the difference in capital cost between fluorescent and its gaseous discharge rivals less than £10, a sum saved in running costs in a little over two years.

I have a feeling that the champions of sodium and h.p.m.v. overlook the fact that in the past few years fluorescent lighting has developed considerably both in extended life and improved lumen efficiency but no such developments have taken place with sodium and mercury. Arguments that applied in 1948 are outdated in 1953 and, if this progress continues—as it has every indication of doing in some quarters—fluorescent lighting will certainly dominate our streets in the not too distant future.

Thames Ditton, Surrey. LIONEL G. HILL, D.F.H.

Artificial Respiration

DURING his summer holiday, one of this Board's meter fixers, Mr. A. Kitching, was with his family on the beach at Withernsea, Yorkshire, when a man who had gone to the rescue of some girls who were in difficulties, collapsed and was apparently drowned. None of the bystanders seemed to know what to do, but Mr. Kitching immediately commenced artificial respiration (by the Holger Nielsen method), and within fifteen minutes the man had been brought round. It is interesting to note that the man in question is an employee of another nationalized industry in the same area as the Board.

In addition to the satisfaction felt by Mr. Kitching, it also brings satisfaction to those who have initiated and carried out the training in artificial respiration.

Scarcroft, Leeds. JOHN M. DODDS, *Secretary*, Yorkshire Electricity Board.

Electric Railway Restarted

Stated to be the first electric railway in Great Britain to operate on electricity supplied directly from the grid, the train service linking Lancaster with Morecambe and Heysham restarted last week. The original Lancaster-Heysham electric railway, which closed in February, 1951, when the rolling stock had worn out, was designed to run on a.c. at 25 c/s. The new train equipment is designed to operate at the standard frequency of 50 c/s.

Dangerous Installations

Liability of Occupier and Supply Authority

By C. F. MAYSON, A.M.I.E.E.

IT has been pointed out in previous articles that the responsibility of the occupier of a factory towards his employees is not necessarily confined to observance of the Factories Acts and of the Regulations made thereunder. Because penalties can be imposed for breach of their provisions, the Acts and Regulations are inclined to be interpreted strictly by the Courts. The result of this might be that, although an employee has been injured through some fault on the part of his employer, he is unable to succeed in a claim alleging breach of statutory duty. However, it must be remembered that the safety legislation is but a particular application of the common law rules as to the duty of care which is owed to all employees, and these rules may be utilized to pin down responsibility for the injury.

Manchester Case

The liability of an occupier may extend to persons other than his employees and the duty of care to both employees and those other persons may be shifted from the occupier to someone else. An illustration of this is afforded by the recent case of *Hartley* v. *Mayoh and Co. and North Western Electricity Board.** This was heard at the Manchester Assizes, and it has not, for that reason, the same authority as it would have had it been tried in the High Court in London. Consequently, it cannot be said to state a proposition of general application, though it is, nevertheless, of considerable interest.

The facts were that a fire broke out on an upper floor of the company's factory, and the fire brigade was summoned. The fireman responsible for seeing that mains supplies of electricity and gas were cut off was directed by the company's manager to the main switchboard, where he was shown two ironclad switches. He switched these off and went to the fire, but, having received a slight shock from some wiring, he returned to the switchboard to investigate further. He was told by the manager that there were no other main switches, and that both the switch controlling the lighting on the upper floor and that in the room where the fire was, were "off." The fireman returned to the fire and, later, was killed through contact with a live wire.

Evidence was given that there were two tumbler switches on the main switchboard which served as the main control of all lighting circuits. They had originally been linked by a wooden handle, but the link was missing, and there was no other indication of their purpose, which was unknown to the manager. The two switches on the upper floor were both of the single-pole variety. Some months before the fire the Electricity Board had fitted a new kWh meter for lighting; examination after the fire showed that the connections between the meter, the neutral and the tumbler switches were reversed. It was fairly clear that this reversal must have taken place at some time before the fixing of the new meter.

Judge's Decision

Mr. Justice Barry's decision in this case was extremely comprehensive. For convenience, and as an aid to understanding, it is set out in the following numbered paragraphs:—

(1) Although firemen should understand the normal methods of cutting off the supply of electricity to a building, they are not required to possess detailed knowledge of obsolete mechanisms. Thus, the fireman could not be blamed for not recognizing the function of the two tumbler switches.

(2) The status of the fireman was equivalent to that of an "invitee." (An "invitee" is a person who is allowed on to premises because he has business there and it is the duty of the occupier to give him fair warning of any danger, which is known or ought to be known to the occupier,

* (1953) 2 *All England Reports*, p. 525.

and which the invitee cannot be expected to foresee.†)

(3) The company should have been aware of the way to switch off the lighting circuits and should have known that the tumbler switches constituted an unusual danger. By not warning the fireman it had failed in its duty towards him as an invitee.

(4) The company had failed to comply with Regs. 1, 7 and 9 of the Electricity (Factories Act) Regulations, 1908 and 1944, and it would clearly have been liable had an employee been injured. "Danger" is defined in the Regulations as danger "to persons employed." The Judge held that these words would include any person lawfully employed on the premises, even though not employed by the occupier. The fireman was certainly "employed" on the premises, and, therefore, by failing to comply with Regs. 1 and 7 (in which the word "danger" is used), the company was in breach of its statutory duty toward him.

(5) The Board had been negligent within the rule in *Donoghue* v. *Stevenson*.‡ (Put shortly, the rule is that there is a duty to take reasonable care to avoid acts or omissions likely to injure anyone who may be directly affected by them; he should, therefore, be in the mind of the person responsible for them.) The Board, when connecting the new meter, had not tested the connections and it should have been aware that omission to make a proper test would be likely to cause damage or injury to persons, lawfully on the premises, who might come into contact with the wiring of the lighting system. It could not be reasonably contemplated that the company would examine the connections, for it would be justifiable to assume that the mains supply was properly connected. The failure to test was therefore a negligent omission, and constituted a breach of the duty owed by the Board to the fireman.

(6) His Lordship thought that the Board was probably in breach of Reg. 25 (a) of the Electricity Supply Regulations, 1937, in that the leads from the meter and neutral to the switches, though originally supplied by the occupiers, were under the Board's control.

† See "Aspects of 'Negligence,'" C. F. Mayson, *Electrical Review*, 16th May, 1952, p. 1061.

‡ (1932) *Appeal Cases*, p. 562.

In the result, the company and the Board were each in breach of duty both at common law and by statute. The fault of the company was comparatively slight and the principal blame was upon the Board. The damages awarded to the plaintiff (the widow of the deceased fireman) were therefore apportioned as to 10 per cent against the company and as to 90 per cent against the Board.

This decision, as it affected the Board, must not be confused with that given by the Lord Chief Justice in *Homer* v. *Southern Electricity Board*,§ where it was held that an electricity supply undertaking was under no duty, when inspecting and connecting extensions to existing installations, to carry out a test of the whole installation. That does not mean that no test at all need be made. In the *Homer* case a polarity test was made, but in the *Hartley* case it seemed that there had been no such test when the new meter was installed; if there had been, the reversed polarity would have revealed itself at once. No blame was attributed to the meter fixer, because it would have been impossible to reverse the leads were no more done than was essential to change the meter.

But Mr. Justice Barry held that that was not enough, and he obviously meant to imply that whenever an Electricity Board does anything at all to a consumer's installation, the polarity should be tested as a matter of routine. Whether the duty arises under the Regulations or the common law rules does not matter; in either case it is owed to anyone, lawfully on the premises, who is injured as a result of such neglect.

§ See "In the Courts," *Electrical Review*, 17th July, page 146.

E.I.B.A. Branch Activities

THE annual carnival dance organized by the Birmingham Branch of the Electrical Industries Benevolent Association will take place at the G.E.C. Magnet Club, Witton, Birmingham, on Friday, 9th October, from 8 p.m. to 1 a.m. Tickets (5s each) will shortly be available from the hon. secretary, Mr. L. Wall, Electrical Components, Ltd., Ludgate Hill, Birmingham, 3. This event has proved very successful over the past years and it is hoped that this year will surpass all previous efforts.

The fourth annual ball of the Hants & Dorset Branch is being held on 5th February at the South Parade Pier Pavilion, Southsea.

Automatic Voltage Regulators

Evolution of the Normally-Inactive Type

By A. H. GRAY, M.Sc., M.I.E.E., and D. R. FENWICK, A.M.I.E.E.*

TO-DAY the automatic voltage regulator is so familiar to generating engineers that it may be thought that machine and regulator appeared simultaneously. Actually the regulator came a number of years after the machine. In those days it was realized that the constancy of the consumer's supply voltage was influenced by the drop in voltage across the leakage reactance of the a.c. generator armature windings and the reaction of the load currents in these windings on the field system; to give satisfactory service it was necessary to maintain both this reactance and the armature reaction at the minimum. The influence on the design of early a.c. generators was great and resulted in physically large machines with large air gaps and heavy excitation systems. Apart from the cost of such large machines, the low leakage reactance involved high short-circuit currents, and so the switchgear, too, had to be of the most robust and expensive construction.

Early in the century it was a rarity to have a.c. generating stations operating in parallel; accordingly to-day's conception of increasing the stability of interconnected synchronous machines by automatic regulation of their excitation systems had little application. Nevertheless, as an all-round economy measure the idea began to find favour of designing machines with higher leakage reactances and smaller field systems, with means for compensating automatically for the large voltage variations that would necessarily ensue.

To appreciate the development of automatic voltage regulators from those early times it will be useful to consider the fundamentals of the problem. If an a.c. generator suddenly has load thrown on to it, the effect is an instantaneous drop in voltage of a magnitude dependent upon the leakage reactance of the machine and the power factor and magnitude of the load applied.

The application of this load changes the magneto-motive force in the generator magnetic system, which in the case of all but capacitive loads reduces the total flux in the air gap of the machine and consequently the generated voltage. This so-called armature reaction effect cannot change the air gap flux instantaneously because the sudden change of m.m.f. induces counter-excitation currents in the field system, the field winding components of which gradually die away. The effect of applying the load can thus be summed up as follows:

(1) An instantaneous drop in voltage, with a corresponding instantaneous rise in field voltage.
(2) A gradual decay of the generator terminal voltage as the armature reaction effect makes itself felt.

The application of a sudden capacitive

* Metropolitan-Vickers Electrical Co., Ltd.

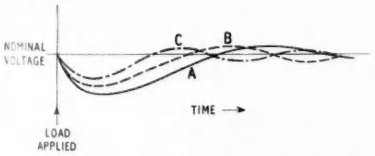


Fig. 1.—General performance of regulating system with three response rates, A slow, B moderate and C fast

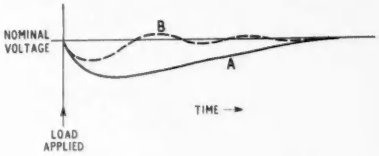


Fig. 2.—Regulating system characteristic, A without and B with forcing

load can similarly be shown to be as follows:

(1) An instantaneous rise in voltage, together with a corresponding instantaneous fall of field voltage.
(2) A gradual rise of the generator terminal voltage as the armature reaction effect makes itself felt.

The conditions just described are amongst the most severe that have to be met by the automatic voltage regulator, and the phenomena that result greatly influence the design of the regulating system. The object in such cases is to minimize the maximum deviation of the generator terminal voltage from its normal value and to restore it to this value in the least possible time and with the smallest number of "overswings." The action of the regulator must be to change the excitation of the machine in such a way as to oppose any deviation in the controlled voltage; in the cases cited the speed with which this can be effected is particularly significant. The speed with which a regulating system can respond is a function of the dynamic characteristics of the regulator itself, the exciter, and the generator. Of these the generator causes by far the greatest response lag, and the regulator—if this is of the quick-acting pattern—causes the smallest lag.

Fig. 3.—An early type of Metropolitan-Vickers voltage regulator (vibrating contact pattern)

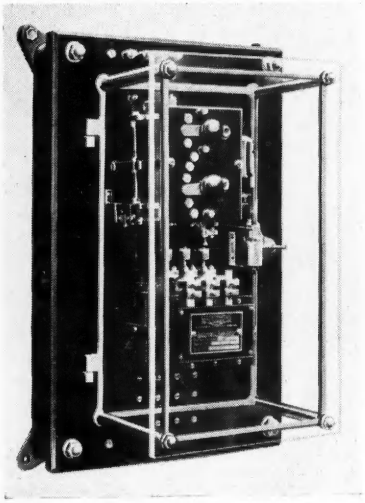
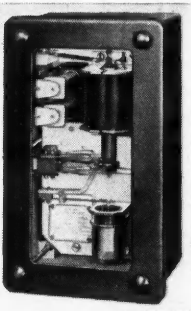


Fig. 4.—Metropolitan-Vickers automatic voltage regulator type VSA



Where there are sudden load changes with consequent induced currents in the generator field system the combination of quick-acting regulator and high-speed exciter is particularly advantageous as it is then possible to arrest the collapse of the induced field currents soon after their inception, thereby mitigating the effect of the time constant of the alternator field system with a consequent reduction in recovery time. Fig. 1 illustrates the general performance of regulating systems with three different response rates for the case of the sudden application of an inductive load.

The necessity for rapid response of the regulator is thus apparent, but this in itself is not sufficient if the best overall performance is to be attained. A proportional movement of the regulator control element from a setting corresponding to the excitation before a disturbance to that subsequent to it is of little value because a considerable time would elapse before the machine excitation would rise to its final value. Rapid change of machine excitation demands that the regulator force the excitation by initial over-correction with return to the new value before serious overshooting can result. Fig. 2 illustrates the characteristics of two regulating systems with the sudden application of an inductive load: one arranged to initially force the excitation, the other to operate without forcing.

Having examined the principal design requirements let us consider the methods employed in achieving them. From early days, exciter field systems have been controlled by an adjustable rheostat, variation of the value of which raised or lowered the exciter voltage and this in turn the a.c. generator voltage. It was in the automatic

adjustment of the exciter field current that the greatest possibilities for voltage regulation were seen, owing to the relatively small power to be handled.

Two principal methods of automatically adjusting the exciter field current were developed: one balanced the output torque of a Ferraris type induction motor against a reference in the form of a spring; the other balanced the combined pulls of a spring and an electromagnet against the weight of a moving iron. Both types of regulator employed a " recall system " in the form of an adjustable spring that coupled the moving system to an adjustable damper.

In the first case variation of the voltage resulted in a rotary motion of the torque motor shaft, which was employed to move a rolling contact over segments connected to taps on the exciter field control resistances. In the second case the movement due to voltage variation was in the form of the raising or lowering of a beam carrying a contact. This beam contact was arranged to make circuit with a second contact, which vibrated either under the influence of the exciter voltage variation or by the action of a pendulum-controlled electric vibrator system. The contacts were arranged to complete the circuit through the operating coil of a high-speed contactor, the contacts of which were so connected as to short-circuit the exciter field rheostat whenever the coil circuit was interrupted. Hence the position of the beam determined the ratio of make to break of these small contacts, which in turn determined the level of excitation in the field system of the controlled exciter.

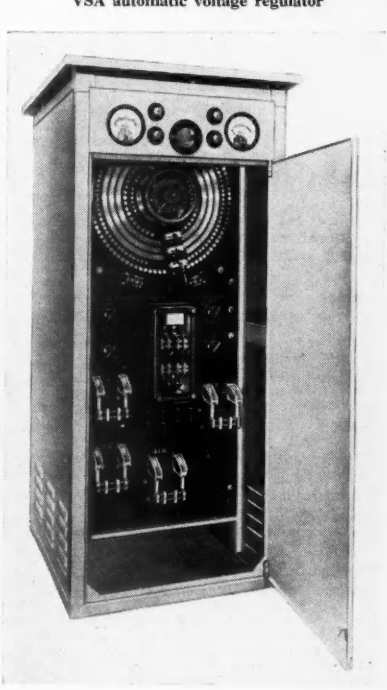
Each of these systems achieves the required objective but by widely differing means; the tendency is for the first system to be somewhat slower in action than the second, whereas the second is more subject to wear and tear than the first.

Development in this country followed the vibrating contact system, an example of which is shown in Fig. 3. This early regulator was of the so-called " active " type and depended for its trouble-free operation on the smoothness of control. In this type of regulator the smoothness of control is dependent on the steadiness of the vibratory mechanism, and it was largely with a view to increasing the reliability of this item that fundamental changes to the design were subsequently made. The pivoted pendulum oscillator system was replaced by a motor-driven cam arrangement, and the main beam pivots by a leaf-spring suspension unit. The motor was of the shaded pole induction type without any brushgear, which might have detracted from the reliability of the equipment.

The " active " type of regulator is suitable for the control of all generating plant, but when the load is reasonably steady the role of the regulator is defined not so much by that of a controller as by that of a relay system standing by to meet changing conditions. It was with this in mind that the " normally inactive " or " sequence operated " regulator was developed some twenty-five years ago to minimize maintenance requirements.

The scheme adopted was to arrange the regulator with two sets of beam-operated contacts, one set to operate with low voltage only and the other with high voltage only. With the voltage normal neither set

Fig. 5.—Field control cubicle for use with type VSA automatic voltage regulator



operated and the error necessary to cause operation was of the order of ±1 per cent. Each set of contacts actuated a separate high-speed contactor. The high-speed contactor associated with lowering was fitted with a normally-closed contact which was connected between one end of the field rheostat and the slider, and that associated with raising was of the normally-open type and connected between the slider and the other end of the rheostat. In practice the rheostat was moved by hand to the position corresponding to the load at which setting the high-speed contactors became inoperative; any variation in voltage was immediately restored by the vibration of the appropriate contact.

This development was a noteworthy advance and is the root of many modern regulating systems.

The era of this manually reset normally inactive regulator was short lived, however, and designs were soon forthcoming to arrange for the automatic adjustment of the load setting of the exciter field rheostat. Auxiliary contactors initiated by the lowering and raising high-speed contactors were employed to energize the raising or lowering windings of a rheostat driving motor. The action in the event of a change of load was that the appropriate high-speed contactor quickly restored the machine terminal voltage by vibratory action across the appropriate section of the exciter field rheostat while the auxiliary contactor energized the rheostat driving motor which moved the slider of the rheostat to the new load setting, thereby restoring a state of quiescence.

The increasing complexity of power stations has made it important to limit the apparatus in the control room to those items essential to operating efficiency. It is with this background that the switchgear engineers of to-day arrange control rooms, the most modern examples of which are of an æsthetic yet strictly functional design. The controls of automatic voltage regulators are among those that must be situated in the control room; it is with a view to simplifying these and easing the installation requirements that the normally inactive regulator shown in Fig. 4 has been designed.

The principal feature of this equipment is that the bulk of the associated wiring and apparatus is situated in the main exciter rheostat cubicle, shown in Fig. 5, the whole constituting a unit of standard and compact design that improves both station layout and accessibility for maintenance.

NEXT WEEK'S EVENTS

Tuesday, 1st September, to Saturday, 12th September

LONDON.—Earls Court. Radio and Television Exhibition.

Tuesday, 1st September

EDINBURGH.—25, Charlotte Square, 7 p.m. Incorporated Plant Engineers, Edinburgh Branch. "The Factories Acts 1937 and 1948 as they affect the Plant Engineer," by Miss G. M. Mitchell.

ELTHAM.—Congregational Church Hall, Court Road, 8 p.m. A.S.E.E. South-East London Branch. "Radio Interference Suppression."

LONDON.—At the Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. Incorporated Plant Engineers, London Branch. "Factories Act Requirements affecting the Plant Engineer," by H. Eccles.

Wednesday, 2nd September, to Wednesday, 9th September

LIVERPOOL.—British Association for the Advancement of Science. Annual meeting.

Wednesday, 2nd September

PRESTON.—Chamber of Commerce, 49a, Fishergate, 7.30 p.m. A.S.E.E. Preston Branch. "Power Without Smoke" and "Agricultural Motors," by F. E. Beake, A.M.I.E.E.

SOUTHAMPTON.—Polygon Hotel, 7.30 p.m. Incorporated Plant Engineers, Southampton Branch. "The Approach to Maintenance—a discussion of the report of the Specialist Team on Plant Maintenance on their visit to the U.S.A.", by Colin Troup.

Thursday, 3rd September, to Thursday, 17th September

LONDON.—Olympia. Nineteenth Engineering, Marine and Welding Exhibition.

Thursday, 3rd September

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South-East London Branch. "Mineral Insulated Cables," by G. E. D. Redman.

Friday, 4th September

LIVERPOOL.—At Liverpool Engineering Society, 21, Dale Street, Liverpool, 2. A.S.E.E. Liverpool Branch. Chairman's address by G. Jelley.

Gas Turbine Lectures

Mr. Roy C. Orford, M.Sc., C.P.A., A.M.I.E.E., patents manager of Power Jets (Research & Development), Ltd., is to give a course of evening lectures on gas turbine technology at the South East London Technical College, Lewisham Way, S.E.4, starting on 13th October. The course will consist of ten weekly lectures and the fee is £1 15s.

OVERSEAS ELECTRICAL TRADE

Exports Recover in July

LAST month the value of Great Britain's electrical export trade, at £16,035,566, was higher than in any previous month this year as well as being £477,219 more than in July, 1952. Perusal of Table I shows that greater exports of electrical machinery were responsible for the increase, notably those of switchgear and switchboards (other than telegraph and telephone) which expanded by nearly 50 per cent compared with a year ago.

In the main group—goods and apparatus—exports of wires and cables increased in value by £332,437 to £3,234,232. It is interesting to observe that larger purchases

TABLE I.—ELECTRICAL EXPORTS

Class	July, 1952	July, 1953	Class	July, 1952	July, 1953
	£	£		£	£
Telegraph and telephone cables and wires (submarine)	55,950	44,041	Insulating cloth and tape	65,294	38,919
Ditto, not submarine	657,728	1,024,417	Other insulating materials	75,499	79,827
Cables and wires, paper insulated	1,086,969	1,218,466	Unclassified electrical goods and apparatus	575,532	638,602
Ditto, rubber insulated	685,523	488,835	TOTAL, electrical goods and apparatus	9,817,491	9,544,689
Ditto, cotton, silk or artificial silk insulated	62,255	53,441			
Ditto, enamel, glass or asbestos insulated	70,146	93,641	Diesel driven generators, not exceeding 10 kW	408,955	83,280
Ditto, other	283,224	311,391	Ditto, over 10 kW to 65 kW		125,532
Commercial radio apparatus	878,815	800,676	Ditto, over 65 kW to 200 kW		67,109
Domestic radio apparatus	404,434	319,578	Ditto, exceeding 200 kW	127,106	295,900
Telegraph, telephone and signalling apparatus	1,621,073	1,581,175	Other generating sets	316,450	290,793
Loudspeakers and microphones	55,640	40,272	Generators and parts of generators	518,013	573,043
Radio, telecommunication and electronic apparatus components and parts, n.e.s.	515,828	430,270	Motors, railway, tramway and trolley-bus	760	—
Other radio, telecommunication and electronic apparatus	112,140	263,348	Ditto, others not over ½ h.p.	131,448	118,268
Cathode ray tubes	10,024	23,315	Ditto, over ½ h.p. but under 1 h.p.	57,092	28,129
Other valves	326,678	170,527	Ditto, from 1 h.p. to 250 h.p.	383,941	409,289
Carbons	19,395	17,782	Ditto, exceeding 250 h.p.	150,588	65,574
Lamps, exceeding 24 V	65,689	60,810	Ditto, parts	86,800	171,465
Ditto, not exceeding 24 V	37,141	27,264	Converting machinery	20,487	39,560
Other lighting appliances	562,032	433,446	Transformers, including coils	774,941	1,098,823
Primary batteries	200,249	211,673	Mercury arc rectifiers	70,825	51,006
Parts other than carbons	19,447	19,296	Motor starting and controlling gear	262,509	274,600
Accumulators for motor vehicles	127,695	129,927	Switchgear and switchboards (not telegraph and telephone)	1,096,023	1,627,973
Ditto, traction	9,257	13,877	Electrical machinery, n.e.s.†	369,043	65,795
Ditto, radio	4,949	1,452			
Other portable accumulators	57,554	29,056	TOTAL, electrical machinery	4,774,981	5,386,139
All other accumulators	127,135	33,729			
Parts and accessories	73,823	36,055			
Cooking appliances	86,507	77,871	Washing machines (not exceeding 150 lb weight)*	317,633	242,473
Heating appliances	75,989	61,515	Ditto (over 150 lb but not exceeding 250 lb weight)*		60,692
Parts and accessories for cooking and heating appliances	85,341	75,557	Ditto, parts	40,377	58,346
Flat irons	58,660	61,019	Vacuum cleaners	16,542	21,180
Commercial electrical instruments	162,028	146,595	Ditto, parts	140,473	165,844
House service meters	129,582	86,642	Other electrically operated portable appliances	17,166	30,595
Time recorders and time switches	9,154	29,745	Portable electric tools	155,958	219,549
Other electrical instruments	151,673	167,134	Electrical pottery and glassware, including insulators	128,330	99,683
Electro-medical apparatus (not X-ray)	37,757	46,404	Electrical conduit tubes and cased tubes	102,719	85,719
X-ray apparatus, other than tubes and valves	85,576	60,971		46,677	120,657
Vacuum tubes	48,615	70,486			
Permanent magnets	38,891	27,642	GRAND TOTAL	15,558,347	16,035,566

* Not separately distinguished in 1952.

† The two figures are not comparable.

by foreign countries were concerned in this improvement; for example £724,252 worth of telegraph and telephone wires and cables (other than submarine) went to these markets out of a total of £1,024,417 exported. From Table II it will be seen that Australian purchases of goods and apparatus advanced from last year's low figures, but India remained the chief buyer (£961,707). Among smaller markets, Nigeria took twice as much as last year and Kuwait, with its expanding oil industry, has so far this year bought British electrical goods and apparatus to the value of £612,996 compared with £304,162 in the corresponding period of 1952. Against this, there has been a contraction in exports to a number of countries, among which may be mentioned Pakistan, Malaya, Ireland, Yugoslavia, Egypt, Brazil, Uruguay and Argentina.

Table II.—Distribution of Electrical Goods and Apparatus

Destination	July, 1952	July, 1953
	£	£
Channel Islands	32,835	32,991
Gibraltar	14,193	6,065
Malta and Gozo	11,420	6,529
Cyprus	17,189	29,452
Gold Coast	42,626	73,499
Nigeria	79,755	166,035
Union of South Africa	817,963	766,941
Northern Rhodesia	55,914	40,512
Southern Rhodesia	182,998	133,751
British East Africa	170,793	226,952
Bahrein, Qatar and Trucial Oman	47,957	47,134
Kuwait	64,866	126,390
India	1,427,612	961,707
Pakistan	271,080	53,173
Malaya	423,544	291,087
Ceylon	86,636	121,662
Hong Kong	127,598	101,713
Australia	488,542	646,291
New Zealand	724,890	551,112
Canada	315,748	251,316
British West Indies	110,770	121,637
Anglo-Egyptian Sudan	55,188	74,469
Other Commonwealth Countries	120,084	322,445
Irish Republic	300,666	173,864
Soviet Union	53,329	33,691
Finland	102,496	26,258
Sweden	377,594	385,628
Norway	292,385	145,662
Iceland	11,912	12,517
Denmark	87,127	110,773
Poland	11,282	12,332
Western Germany	63,145	103,622
Netherlands	345,200	228,255
Belgium	174,118	180,428
France	99,349	178,168
Switzerland	52,774	108,045
Portugal	89,713	111,521
Spain	37,240	61,738
Italy	76,573	123,675
Austria	21,992	45,191
Czechoslovakia	9,549	2,110
Yugoslavia	80,311	9,176
Greece	31,877	48,374
Turkey	116,170	113,867
Portuguese East Africa	13,101	6,010
Syria	12,590	12,200
Lebanon	11,221	34,121
Israel	10,690	26,243
Egypt	112,182	83,780
Arabia	41,249	41,359
Iraq	80,527	134,712
Iran	13,072	22,074
Burma	63,583	67,925
Thailand	72,852	63,567
Indonesia	132,848	62,588
China	316	108
United States of America	107,942	138,452
Colombia	88,130	33,367
Venezuela	53,940	84,543
Peru	31,274	42,273
Chile	37,286	12,252
Brazil	260,022	119,288
Uruguay	19,774	8,932
Argentine Republic	169,242	35,896
Other Foreign Countries	360,647	1,147,291
Total	9,817,491	9,544,689

Australia was the principal buyer of generating plant exported last month (£354,624) followed by Canada (£207,274). The success of British plant manufacturers in the latter market is shown by the fact that exports of this kind to Canada in the seven months to the end of July have amounted to £1,280,427 against only £258,395 in January–July last year. Electric motor exports were slightly below the level of a year ago, but there was a substantial improvement in the class "other electrical machinery" (from £2,593,828 to £3,157,757). South Africa last month took £712,173 worth of this kind of equipment (against £558,600), followed by India £466,100 (£352,640), Australia £379,573 (£221,119), Spain £182,863 (£53,519) and Venezuela, £182,190 (£3,108).

Industry in the Philippines

AN agreement has been signed between the Government of the Philippines and Caltex (Philippines), Inc., which provides for the installation of the first oil refinery there. The plant will, it is estimated, cost in the region of 60 million pesos (£10·7 million) and is expected to be completed by the end of 1954. In its initial stages it will process some 13,000 barrels of crude oil per day, but will be capable of expansion to a total capacity of 25,000 barrels.

A cotton spinning plant is shortly to be installed at Manila and a new jute mill will be set up in Davao city at estimated costs of 2 million and 1·5 million pesos, respectively. Both factories will be equipped with British machinery.

The first television station in the islands is expected to be in operation at the end of this month. The service is being introduced by the Bolinao Electronics Corporation of Manila, the complete equipment being supplied by the Radio Corporation of America.

COMMERCE and INDUSTRY

Canadian Trade Trends this Year

Minister's Decision on Trafalgar Square Signs

DURING the first quarter of this year imports of electrical apparatus into Canada increased in value by nearly 50 per cent and totalled $46,067,000, while exports rose by roughly one third and amounted to $10,759,000.

On the import side the United Kingdom stood out again in special steam generators with $1,858,000 worth out of a total of $1,953,000 and did some business too in other dynamos and generators, with $146,000 out of $2,076,000. In the face of competition not only from the United States but also from nine countries of Continental Europe, the United Kingdom participated also in the motor trade to the extent of $495,000 out of $4,189,000. Television receiving sets were imported from the United Kingdom to the value of $328,000 out of $681,000, with the United States taking the rest of the business.

A feature of the export trade was the expanding business in radio goods, including receiving sets totalling $337,000, to fifty-two different destinations, and radio apparatus n.o.p. valued at $6,790,000, while telegraph and telephone apparatus were valued at $506,000, dynamos, generators and parts at $777,000, and motors and parts at $439,000.

Torquay Convention Papers

The papers presented at the Torquay British Electrical Power Convention by Mr. S. F. Steward, C.B.E., and Mr. E. R. Wilkinson, with the contributing papers in each section, are being reprinted with the discussion in two separate volumes. Those desiring copies should apply to the Secretary, British Electrical Power Convention, 16, Stratford Place, London, W.1. The approximate price (post free) will be 6s 6d each.

Diesel Sets for Gold Coast

Two more diesel alternator sets have been ordered from Mirrlees, Bickerton & Day, Ltd., by the Crown Agents for the Colonies for the Gold Coast Electricity Board's power station at Sekondi. The new sets are powered by Mirrlees KS.7 seven-cylinder, vertical, turbo-charged engines, each developing 1,331 b.h.p. at 375 r.p.m., coupled to Brush alternators of the revolving field, salient pole, protected type, wound for 6,600 V, 50 c/s, 3-phase, each fitted with flexibly coupled exciter and exciter field regulator. The output of each will be 750 kW, 937·5 kVA at 0·8 power factor. With the installation of the two new KS.7 generating sets the total capacity of sets supplied by Mirrlees since 1951 will be 6,000 kW.

Australian Tariff on Meters

It is stated in the *Board of Trade Journal* that the Australian Minister for Trade and Customs has asked the Tariff Board to inquire into and report upon what rates of duty should be imposed on a.c. watt-hour meters. At present two-rate, two-rate and three-element combined and three-element, other than two-rate, meters of British make are admitted free of duty; on other countries' makes duties of 10 or 12½ per cent are levied. On other meters of British make the duty is 6s 8d each: the most-favoured-nation tariff is 11s 8d and the general tariff 13s 4d.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 15th August is deemed to be 141s 6d. The "cost of material" figures are as follows:—

For electrical machinery and equipment: the Board of Trade index figure published on 15th August is 152·8.

For turbo-generating and allied plant: materials used in mechanical engineering industries, 144·5; blast furnaces and iron and steel smelting and rolling (40 and 41), 144·5; price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 14th August), 3s 6¾d per lb.

Outstanding contracts covered by the Board of Trade intermediate products index: the index figure for intermediate products (15th August) is 354·2.

Instrument Dimensions

The British Standards Institution has issued recommendations (B.S. 1986) for certain of the dimensional features of industrial measuring and control instruments and of the panels in which they are mounted. The intention is to encourage the adoption of the principle of interchangeability and to ensure satisfactory operation in cases in which items of equipment complying with the recommendations are connected together, even when they have been

made by different manufacturers, so that agreement to standardize other details of such instruments will be the eventual outcome. Copies may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 3s.

"Model Engineer" Exhibition

Two radio controlled motor torpedo boats, one of which lowers a self-propelled launch, form one of the special features of the "Model Engineer" Exhibition which until to-morrow is being held at the New Horticultural Hall, Westminster. Other radio controlled boats are to be found in the competition section, which includes in addition to the usual large number of locomotives, engineering models, aircraft, etc., a battery operated wall or pedestal clock and a "Eureka" clock.

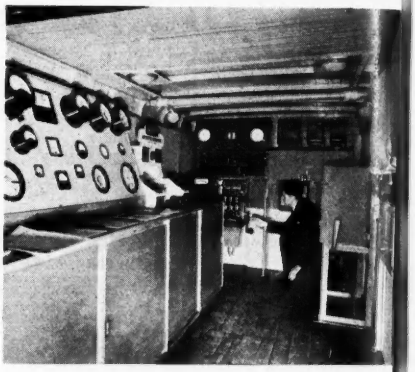
Among the trade exhibitors, Chloride Batteries, Ltd., besides displaying a complete range of "Drydex" dry batteries and "Exide" miniature cells for all electrically driven and radio controlled models, show how to make the hull of a powered boat entirely from paper. Electrically operated tools are demonstrated by Black & Decker, Ltd., Buck & Ryan, Ltd., E. W. Cowell, Ltd., the Myford Engineering Co., Ltd., and S. Tyzack & Son, Ltd. Components, drawings, etc., for the home construction of domestic refrigerators are offered by Braid Bros.

Decca Airfield Radar

A contract has been placed with Decca Radar, Ltd., by the Newcastle Municipal Airport (Woolsington) for the installation of Decca airfield radar, Type 424, which enables any aircraft with radio communication equipment to be landed under conditions of poor visibility. It also enables an area within 25 miles of the airfield to be searched continuously for aircraft, thereby increasing the efficiency of air traffic control. A mobile unit of this type will be demonstrated at the S.B.A.C. flying display and exhibition at Farnborough in September.

Mobile Showroom

An opportunity for potential users of its instruments and switchgear to study the equipment and have its technical features explained is provided by a mobile showroom now being operated by the General Electric Co., Ltd. Travelling with the showroom, which is visiting factories and contractors' premises on a country-wide basis, are representatives of the company's switchgear, instrument and sales departments. The showroom is spacious enough to house a section of a switchboard built up from such standard components as a busbar chamber, meter chamber, adaptor boxes, medium weight switch-fuses and fuse-switches and pedestals. Other switchgear exhibits include samples from the medium weight range of switch-fuses with



Interior of G.E.C. mobile showroom for instruments and switchgear

appropriate cable boxes, a sample of a 30 A distribution fuseboard in a pressed steel case, miniature circuit breakers and earth leakage circuit breakers. The other wall of the showroom is devoted to a display of the G.E.C. standard range of switchboard and portable instruments and to a demonstration unit which illustrates the usefulness of link testing ammeters and wattmeters.

Wholesalers' New Catalogue

For the first time since 1936 the London Electrical Co. (Blackfriars), Ltd., Blackfriars Road, London, S.E.1, has issued a comprehensive illustrated and priced catalogue (496 pp.) of the equipment with which it deals. It covers industrial equipment, domestic appliances, lighting fittings, lamps, motors, switch- and fuse-gear, installation material and accessories, and other classes of goods.

Time Control

A paper by Mr. E. Tauchert, general works manager, Venner, Ltd., which he read earlier this year at the British Horological Institute, has been reprinted. It is entitled "Horological Mechanisms in Industry" and deals with the broader aspects of the applications of time switches to the control of some factory processes; it illustrates several kinds of switch and mentions synchronous construction and the testing of devices of this kind.

Copper Developments

A review of recent technical developments in the production, properties and applications of copper and its alloys, with a comprehensive bibliography, is published twice a year by the Copper Development Association under the title "Technical Survey." The first number appeared in January and the second in July.

Copies are obtainable free of charge from the Association at Kendals Hall, Radlett, Herts. This offer is particularly opportune now that all restrictions on the use of these metals have been removed.

Trafalgar Square Signs

The Minister of Housing and Local Government has decided, after the recent appeals against a ban proposed by the Westminster City Council, to permit some of the electric signs in Trafalgar Square to remain for periods varying from about four months to three years. Others are to be removed as being "seriously prejudicial to amenity."

Mr. Macmillan says in a letter to the Westminster City Council that he appreciates the reasons which prompted the Council to refuse permission for the display of the advertisements and that he is in broad agreement that the encroachment of advertisements on buildings which form part of this historic Square is in many ways to be regretted. At the same time, he has felt bound to have regard to the fact that some of these advertisements have been a feature of the Square for many years and are looked upon by many as part of the London scene. While the existing display of advertisements as seen during the hours of daylight is excessive and seriously prejudicial to the amenities of the Square, some display of illuminated signs at night need not be excluded, provided they are suitably designed and sited in relation to the buildings on which they are displayed so as to be reasonably inconspicuous by day.

Works and Plant Engineers

A refresher course for works and plant engineers will be held at Brasenose College, Oxford, from 21st to 25th September. The opening address will be given by Rear Admiral Sir Sydney Frew, K.B.E., C.B., Chief Fuel Engineer, Ministry of Fuel and Power. The course has been designed to provide engineers in industry responsible for fuel utilization with an opportunity to bring themselves up to date in fuel efficiency technique. The fee for the course will be £2 10s. Those desiring accommodation can obtain it at the College for a further charge of £4. Inquiries should be sent to the secretary, Fuel Education Joint Advisory Committee, Ministry of Fuel and Power, Southern Region, Whiteknights, Earley, Reading.

Fatal Shock in a Piggery

The Bridgwater Borough Coroner, Mr. C. Rowe, on 20th August recorded a verdict of "Death from Misadventure" on a farmer, Mr. S. Bown (52), who received a fatal electric shock on 5th August. Bown was fitting a sun lamp in the piggery when the accident occurred.

P.C. Weaver produced the lamp and fittings. The connection was a reversible type which meant that if plugged in a certain way part of the lampholder would become alive. There was no way of knowing which way the connection was fitted and it would be easy to cause a short circuit across the metal shade which Mr. Bown was holding at the time. There would have been no danger if the lamp had been fitted with a properly earthed connection.

New Mersey and Wirral Rolling Stock

A contract valued at £286,000 has been placed by British Railways with the Metropolitan-Vickers Electrical Co., Ltd., covering the manufacture and supply of electrical equipment for new rolling stock on the former Mersey Railway and the Wirral electrified lines. Both sections operate at 650 V d.c. and the Mersey Railway (originally 3rd and 4th rail) is being converted to the third rail system to facilitate the running of through services. The contract covers traction motors and control equipment for 24 motor coaches, 26 trailers and 26 driving trailer coaches; 24 three-coach train sets will be used on the Mersey Railway, and the remainder of the stock is for the Wirral lines. Each motor coach will have four 135 h.p. motors, which are to be made at the company's traction motor works at Attercliffe Common, Sheffield. The control equipment is electro-pneumatic and will be made at Trafford Park.

It is just over 50 years since the British Westinghouse Electric and Manufacturing Co., Ltd. (predecessor of Metropolitan-Vickers) carried out the original conversion of the Mersey Railway to electric traction. This was the first British railway to be so converted and the contract—covering power station, track, rolling stock, ventilation and lifts—was the first traction work carried out by the newly formed British Westinghouse Company. Some additional coaches of more modern design, also with M-V equipment, were supplied in 1923–24, but most of the original trains are still in service and will continue to be used until replaced by new rolling stock fitted with equipment ordered under the new contract.

Platinum Metals Exhibition

The Duke of Edinburgh has consented to open the Platinum Metals Exhibition at Grosvenor House on Monday, 19th October. The exhibition is being held by the Institution of Metallurgists to mark the triple jubilee of William Hyde Wollaston's announcement of his discovery of the precious metal palladium. It will be open to the public from 22nd to 24th October and will show the vital part played by the platinum metals in science and industry to-day.

Window Display Material

A new book, "How to Decorate Windows with Crepe Paper" (price 2s 6d), has been published by the Dennison Manufacturing Co., Ltd.,

Minerva Road, Park Royal, N.W.10. It consists of twenty-eight illustrated pages in two colours with a striking three-colour cover. A useful feature is an illustrated series of twelve specimen window backgrounds, each accompanied by instructions for its erection with information on the quantity of crepe paper needed for a window of given size.

E.C.A. Annual Dinner

Next year's annual dinner of the Electrical Contractors' Association is to take place at Grosvenor House, London, W.1, on 27th January.

Food Mixer Recipes

Probably the first of its kind is a "Food Mixer Book" produced by the English Electric Co., Ltd., to accompany its mixers upon sale. It comprises a collection of recipes for many kinds of dishes and confections in which the mixer can be employed. The book has a handsome coloured washable cover and the recipes are prefaced by a description of the mixer and hints on its use.

Craftsmanship and Draughtsmanship

For the Gauge and Tool Makers' Association's third competition in craftsmanship and draughtsmanship there were nearly 100 entries from apprentices and learners employed by member firms and fifteen prizes were awarded. The winning entries will be displayed at the forthcoming Engineering and Marine Exhibition.

Dry Shaver Sales Aids

Remington Rand, Ltd., 1–19, New Oxford Street, London, W.C.1, has issued literature giving particulars of dealer advertising for the new "Remington 60" electric shaver, which includes illustrations for local advertisements and blocks which are available to dealers.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £150 0s 0d
COPPER, H.C. Electro	ton £230 0s 0d
Fire Refined 99·70 per cent	ton £229 0s 0d
Fire Refined 99·50 per cent	ton £228 0s 0d
COPPER Tubes	lb 2s 3d
Sheet	ton £286 10s 0d
H.C. wire and strip	ton £283 0s 0d
LEAD, English	ton £95 0s 0d
Foreign	ton £93 10s 0d
MERCURY	flask £70 10s 0d
TIN	ton £605 0s 0d
ZINC, G.O.B. Foreign	ton £71 0s 0d
Electrolytic	ton £72 10s 0d
BRASS Tubes	lb 1s 10d
Sheet	ton £235 10s 0d
Wire	lb 2s 5¾d
PHOSPHOR BRONZE Wire	lb 3s 7½d
RUBBER, No. 1 R.S.S. spot	lb 19¼d–19⅝d

Trade Announcements

Dorman & Smith, Ltd., announce that they have acquired all the issued capital of the Oldfield Engineering Co., Ltd., which has for many years designed and supplied transformers and motors.

Mr. A. C. J. Loat has joined the London sales staff of **Higgs Motors, Ltd.,** as technical engineer and will be responsible for districts to the south of the city.

Etches & Wells, Ltd., makers of "Wellco" elements, are moving to larger premises at Codicote, near Knebworth, where an old Tudor style building has been acquired and restored.

L.E.S. Distributors, Ltd., announces that its showroom and radio exhibition at 15-16, Alfred Place, London, W.C.1, will be opened by Miss Elizabeth Allan on 2nd September. A new branch will be opened on 1st September at 54, Milton Road, Southend-on-Sea (telephone : Southend 46466).

Catalogues and Lists

The Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.—Leaflet illustrating the "Ediswan" extra-life battery incorporating microporous separators.

Line Equipment, Ltd., 32, Queen Victoria Street, London, E.C.4.—Illustrated leaflet giving details of the company's range of patent h.r.c. rewireable liquid fuses (LFP.3).

Zero Electric, Ltd., 27a, Bath Road, Walsall, Staffs.—28-page price list of "Zelec" refrigeration supplies and accessories.

Knightshades, Ltd., Derby Road Works, Montagu Road, Edmonton, London, N.18.—New season's list of table lamps, fittings, bedlights and lampshades including "Nylux" shades.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Illustrated priced catalogue of platform and silo grain dryers incorporating "Woods of Colchester" fans.

The Renold & Coventry Chain Co., Ltd., 28, Deansgate, Manchester, 3.—Illustrated catalogue depicting a range of "Renold" flexible couplings (216/160).

British Central Electrical Co., Ltd., 6 & 8, Rosebery Avenue, London, E.C.1.—Illustrated priced leaflet on the new "Vispart" assembly unit and stockholding tray.

Bates & Bates, Ltd., 73, Ashville Avenue, Birmingham, 34. — Pamphlet describing "Synchroheat" electronic welding controls.

A. F. Bulgin & Co., Ltd., By-Pass Road, Barking, Essex.—1953 catalogue of radio, radar, television, electronic and electrical components (191).

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Redesigned Thermal Storage Heater

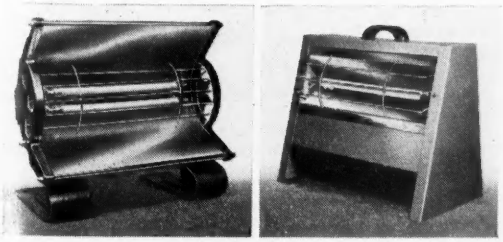
THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has redesigned its thermal storage space heater and now offers it at the reduced price of £12 10s. Although similar in shape to the original heater, it employs, for easier handling, twenty interchangeable concrete blocks which are only half the weight of those used previously. These are enclosed in a bronze-finished steel case which has slightly increased overall dimensions. Lagging is fixed internally to the sides and ends of the case by mild steel strips. The top lagging, which accompanies each heater, is placed on the blocks after assembly. The eight self-tapping screws for locating the top of the heater have been reduced to two, one at each end. The terminal cover plate is also fixed by two screws only. The heater measures overall 26½in wide, 11¾in deep and 29½in high. The loading is 1½ kW.

Electric Fires

The 1953–54 range of fires introduced by REEVES ELECTRICAL & RADIO CO., LTD., Reelek Works, Baldock, includes five reflector units all fitted with guards to British Standard 1670. The type R 1 kW fire, fitted with a chromium plated reflector, is supplied in pastel shades for 35s (plus 19s 3d purchase tax in this country). The types R1 (1 kW) and R2 (2 kW) are constructed in heavy gauge steel and finished in a range of colours: the prices are respectively 28s 6d (plus 15s purchase tax) and 45s 10d (plus 25s 2d purchase tax).

Adjustable reflector fires are made with cast aluminium ends and heavy gauge steel feet with provision for wall fixing. Bronze is the standard finish. The 1 kW model costs 45s 10d (plus 25s 2d purchase tax) and the 2 kW unit, which is fitted with a switch at the rear, 54s 2d (plus 29s 8d purchase tax).

Reeves 2 kW adjustable and 1 kW fixed reflector fires



Glass Marking Colour

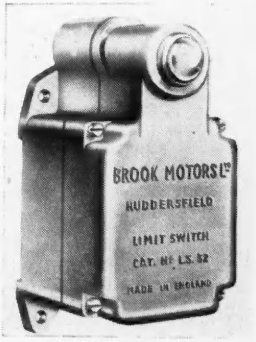
Many industrial uses will no doubt be found for glass marking colour which is available from GEORGE T. GURR, LTD., 136, New Kings Road, London, S.W.6. This ink is permanent, non-corrosive, resists solvents and can be easily applied with either an ordinary pen or a brush. The colours available are black, white, red, orange, yellow, green and blue.

Limit Switch

In the ball-headed plunger limit switch made by BROOK MOTORS, LTD., Empress Works, Huddersfield, the number of parts has been kept to the minimum, thus simplifying maintenance and increasing reliability. Captive fixing screws are fitted in the cover of the die-cast case, and the clamp type terminals are easily accessible. An oil, water and dust resisting rubber gasket is fitted, making the unit impervious to surrounding conditions.

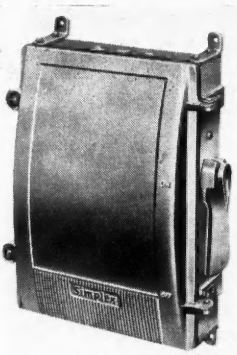
Heavy silver contacts give low resistance and avoid intermittent high resistance copper oxide troubles: there are two circuits, one make and one break. The operating plunger carries a hardened steel rotating striking ball which enables the mounting position (in one plane) to be independent of the direction of travel of

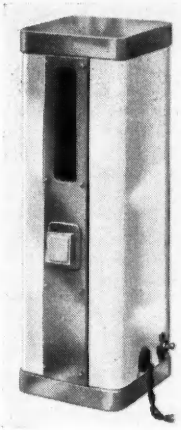
Brook limit switch



the striker nose. Maximum depression of the operating plunger is about $\frac{3}{32}$ in and the pressure required for full depression is 3 lb. The switch is suitable for controlling circuits up to 660 V and the overall dimensions are $4\frac{7}{16}$ in by $2\frac{1}{16}$ in by $2\frac{13}{32}$ in with a $\frac{3}{4}$ in screwed conduit entry.

Lambert striplighting lampholder





Simplex "Regent" 60 A switch-fuse. *Right:* Parkes "Minor" coffee mill

Switch-fuses

With modern smooth exterior design the "Regent" 60 A, 500 V range of switchgear made by the SIMPLEX ELECTRIC CO., LTD., Broadwell, Oldbury, Birmingham, provides easy accessibility and maximum wiring space. Both rewirable and h.r.c. fusing are available and the h.r.c. carrier accommodates cartridges to B.S. 88 : 1952. The design allows for direct mounting on busbar chambers or trunking and can be supplied with thickened end plates to order. The standard model is, of course, weatherproof. The case is of grey cast iron and the standard finish is "Silvex." Alternative finishes of black enamel, battleship grey and galvanized are available at slight extra cost.

Striplighting Lampholders

Robust but inexpensive striplighting lampholders are now available from M. R. LAMBERT, Dunsfold, Surrey. They comprise a single moulding with solid brass conductor spikes and a snap-on metal cover. Installation is extremely simple; the cable is merely pressed into position, as shown in the accompanying illustration, and the cover snapped on. Both bayonet-cap and edison screw patterns are being made.

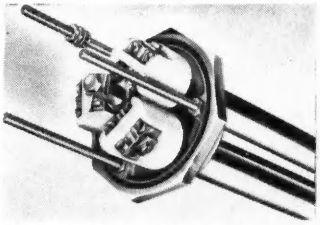
Domestic Coffee Mill

An attractively designed coffee mill for domestic use (the "Minor") is now being made by ZACHARIAH PARKES, LTD., 47–48, Hampton Street, Birmingham, 19. It incorporates a $\frac{1}{15}$ h.p. 200/250 V motor, has a hopper capacity for 1 lb of beans, and grinds at the rate of 3 oz per minute, which is enough to make about 2 pt of coffee. The overall dimensions of the unit are $4\frac{1}{2}$in by $4\frac{1}{2}$in by $11\frac{1}{2}$in, and the weight is 7 lb. The machine is priced at £14.

Industrial Immersion Heater

A 9 kW immersion heater that provides at little installation cost a simple means of converting to electric heating industrial water tanks and cylinders which are at present heated by solid fuel or gas is now available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. A weatherproof cover with a 1in conduit entry is fitted to the heater, which is supplied with a jointing gasket.

The brass head of the heater carries three heavily tinned heating element tubes, brazed into position, from which the cartridge elements can be easily withdrawn without draining the container. The three elements are connected in "star," so that the heater is suitable for operation from a three-phase a.c. supply with neutral, and from a single-phase or 2-wire d.c. supply. Earthing facilities are provided, and wiring instructions are enclosed with each heater.



G.E.C. 9 kW industrial immersion heater

Engineering in Europe

Survey of Current Literature

A LEADING German designer surveys 25 years' development of air and gas blast breakers and draws the final conclusion that, although the breaking capacities of modern breakers do not represent a technical limit (15 MVA at present), it is doubtful whether a further increase of their performance would be economically sound. Not only the breakers themselves become disproportionately expensive, but also other parts of the system, because the dynamic and thermal stresses rise with the square of the currents carried, so that a limitation of the powers on short-circuit and a redesign of the systems on lines of interconnection and subdivision is much more reasonable.

The author gives a well-considered and balanced picture of the basic physical facts, agreeing with the results of research into gas discharge processes, heat exchange, de-ionization and arc quenching, resistance-breaking, and dwells particularly on the question of the rate of rise of the recovery voltage and its theoretical representation. Typical results from American tests on German gas blast breakers, particularly on breaking of idling lines and transformers, illustrate the present impressive standard of performance of this type of breaker.—" Gas Blast Circuit Breakers," J. Biermans, *E.T.Z.(A)*, Vol. 74, No. 10, pp. 281–289, 11th May, 1953, in German.

Surge Protection

While the problem of the protective effect and advantage of the use of earth wires in systems at voltages above 50 kV may be regarded as fully solved, their use in systems below 50 kV has not so far been studied in detail. The authors supplement this information by considering the voltage induced on the conductors, the statistical distribution of lightning currents, the various ideas about protective zones and their geometrical configuration, statistical distribution of lightning strokes on conductor and earth wires, back flashovers, etc., and conclude that earth wires are advantageous for 22 kV lines supported by steel masts throughout, or with few wooden poles among a majority of steel supports and, furthermore, for the lead-in to stations.

Lines without earth wires on wooden poles are 15 per cent cheaper, and also cheaper to maintain; they do not require earthing; the danger of short-circuits by " sleet jump " is reduced by 50 per cent since the " anti-sleet " arrangement of the conductors may be used; the stresses on the poles are reduced and also the capacitive currents (by about 10 per cent). The breakdowns caused by birds and other animals, by back flashovers and successive short-circuits to earth also become less frequent. The " anti-sleet " arrangement of the conductors enables shorter poles to be used, i.e., a further saving is obtained.—" The Importance of Earth Wires in the Surge Protection of H.V. Lines especially at 22 kV," V. Kalousek and J. Jirku, *Elektrotech. Obzor*, Vol. 22, No. 4, pp. 196–202, April, 1953, in Czech.

Insulating Varnishes

A new method for establishing the degree of oxidation of insulating varnishes on an oil, or mixed oil-and-synthetic, base is presented. The oxidation curves obtained for specimens of either type of varnish show that the method, which is described in full detail with the apparatus used for carrying it out, is suitable for the control of the impregnating and drying process, whatever the character of the varnish used. It is also suitable for testing varnishes for oil content. Since the method is based on the measurement of the oxygen quantities required for oxidation, impregnants giving off gases during the drying period would use up less oxygen, or even have a " negative " oxygen consumption and this would be clearly visible in the oxidation curves.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

The unsatisfactory depth effect of drying of oil-base varnishes is quantitatively explained by the character of the oxidation curve in this case (when " sharp " drying is used) indicating the formation of a skin; the remedy is a careful separation into evaporation and oxidation periods by a suitable temperature control during the drying process. It is very doubtful whether any shortening of the total duration of the process is possible without prejudicing the quality of the coat of varnish. The use of anti-oxidants decomposing after some hours at 120 deg C improves the evaporation of the solvents in the case of oil and glyptal varnishes and enables the varnishes to be dried in the open.—" Oxidation of Insulating Varnishes," J. Brablc, *Elektrotech. Obzor*, Vol. 42, No. 4, pp. 211–216, April, 1953, in Czech.

Wind Power

The problems relating to the generation of electrical energy from the wind may be divided conveniently into several groups, the first of which might be called the anemometrical, dealing with incidence and speeds of the wind and, ultimately, the choice of suitable sites for wind power stations; the second with aerodynamical principles of windmill or turbine design (the type of mill is more or less a function of the predominant range of wind speeds exploited). Theoretical research, experimentation and technical development in this field are well advanced. The third, and main group, of problems concerns the choice of the type of generator and its matching to the wind prime mover, the coupling of the two parts of the plant and the regulation of the windmill.

Obviously there is not much interest in producing d.c., since any appreciable contribution to the power economy of any country could only be made by working on three-phase systems, preferably in parallel with thermal and/or hydro-electric power stations. This is so far the trickiest problem, although very promising combinations have been suggested and tried out on a small scale in various countries, among others inverted Ward-Leonard sets, groups consisting of d.c. generator and mercury vapour invertors, and synchronous generators with mercury-vapour frequency convertors. Of the solutions using a single a.c. machine, those with collector machines are most satisfactory, particularly when using the Schrage type. The author gives a comprehensive survey of the work done so far and makes suggestions for an extension of the research programme.—" Experience in the Production of Electric Power from the Wind," A. Asta, *Ricerca Sci.*, Vol. 23, No. 4, pp. 537–558, April, 1953, in Italian.

Rotary Amplifiers

Rotating electrical machines have been used for a long time as amplifiers in three-phase speed control sets in order to supply the slip rings of an induction motor with active or reactive power of suitable frequency generated from a comparatively small input of control power. The desired amplification factor is often obtainable only by a cascade connection of several amplifiers.

In controlled d.c. drives multi-stage amplifiers (amplidynes and multi-stage rototrols) are mostly used. These have the added advantage of a low magnetic inertia, since the utilization factor of the pre-amplification stage is low. This and the high amplification factor are also desirable in a.c. amplifiers, since the low magnetic inertia implies a reduced dependence on frequency in steady a.c. operation. Author shows that the same principles can be used in the design of d.c. and a.c. amplifiers and the modifications required do not really constitute a separate problem.

These principles are explained with reference to a two-pole pre-amplifier with a four-pole, three-phase end stage. The machine, if fairly large, will have salient poles with compoles, thus concentrated field windings, whereas smaller and smallest types may have non-salient poles with distributed windings. The armature is lap-wound with equipotential connections and the machine is similar to a single-stage Scherbius amplifier.

Negative feedback may be used on one of the two, or on both, stages or else differential excitation. If there is phase overlap in the latter case, the phase angle of the series field may be adapted to suit the given operating conditions. Six-phase consumers may be accommodated by providing a six-phase winding. This enables the design to be simplified and cheapened by separate current paths for field current and armature current of the end stage.—" Multi-Stage Three-Phase Rotary Amplifiers," F. Fraunberger, *E.u.M.*, Vol. 70, No. 10, pp. 216–224, 15th May, 1953, in German.

ELECTRICITY SUPPLY

Line Erection Expedient

Analysis of Boards' Sales in July

A LIFE-SAVING rocket used by coastguards was employed to carry an electrical conductor over a ravine and woodland near Rievaulx Abbey in connection with the North Eastern Electricity Board's plan to supply electricity to the upland villages of Cold Kirby, Old Byland, Murton, Hawnby and Hawnby Bridge in the North Riding of Yorkshire. The rocket was fired with a cable attached and landed about half a mile away. This idea was decided upon to save a long period of heavy work and tree-felling. A similar plan was recently adopted for conductor stringing across the Aber Gorge, near Bangor, North Wales (*Electrical Review*, 17th July, page 144).

Change-Over Completed

The Sutton Coldfield District of the Midlands Electricity Board has this week brought to an end a task which has taken 23 years to complete —the conversion of the town's electricity supply from d.c. to a.c. For the past month Sutton Coldfield has had only one d.c. consumer, a laundry, for whose benefit the d.c. supply had been maintained. Now that the equipment at the laundry has been converted Sutton Coldfield becomes one of the few urban districts in the Midlands to have dispensed entirely with d.c.

Faulty Wiring

Stoke Newington Borough Council is concerned at the number of inquiries about faulty electric wiring. It reports that in many cases the London Electricity Board has found defective wiring and has informed the consumer that unless it is repaired the supply may be cut off. Such repairs are sometimes expensive, and in cases of hardship the Council feels that the Board should be reminded of the "assisted wiring scheme" operated when the borough undertaking was municipally owned, under which the cost of wiring was recovered from prepayment meters.

Wicklow Water-Power Scheme

A decision on the siting of the main dam for the Irish Electricity Supply Board's new hydro-electric station near the picturesque village of Annamoe (Wicklow) is expected shortly. Since early last year the Board's engineers have been making test borings at a site in the river valley, just outside the village. If the dam is erected there most of the village will be submerged by the reservoir. Rated next in size to the Erne scheme, the Annamoe project would add an extra 35 million kWh annually to the nation's power supply, and the waters of Lough Tay and Lough Dan, after passing through the plant, would be piped to provide a supply for Wicklow town and district.

Irish Wind Power Investigations

It is reported that the Electricity Supply Board, Ireland, has ordered a 12 kW windmill generator from Germany in connection with the Board's investigations into the possibility of using wind power as a source of electricity supply.

"All-electric" Houses

Ennerdale (Cumberland) R.D.C. has reiterated its refusal to meet representatives of the Northern Gas Board to discuss the supply of

The four white fluted chimney stacks of Fulham power station stand out spectacularly when floodlit at night. Designed by B.E.A. engineers in co-operation with Metropolitan-Vickers illuminating engineers, the lighting installation, which is permanent, consists of 56 140 W sodium discharge lamp projectors to light the main face of the station and 60 narrow-angle projectors each with a 1,000 W lamp for the stacks

gas to the Council's housing estates. The Council is adhering to its policy of supplying only electricity to the estates.

Tenterden, Kent, R.D.C. is considering plans for the erection of all-electric houses for the "higher income groups." After several members had queried the decision to install electric cookers and thermostatically controlled heaters the surveyor (Mr. A. Forder) pointed out that the maintenance of solid fuel stoves in the Council's houses had been quite costly and that the proposed electrical installations would be more economical.

Maintenance Costs

A report to the Liverpool City Council gives the cost of the repair and maintenance of electrical services in council houses in the year to 31st March last. The average figure for 50,257 permanent houses was 3s 4d per house and for 3,502 temporary houses £1 15s 9d.

Site for Offices and Showrooms

Penistone U.D.C. is leasing to the Yorkshire Electricity Board a site on the south side of Park Avenue approach, Penistone, subject to the Board's guaranteeing that the proposed building to accommodate offices and showrooms will be erected within two years.

Lydney Power Station

Some concern is reported locally at the possible closure of Lydney power station. The Trades Council reported the matter to the T.U.C. and has received a reply stating that it appears that no definite decision has yet been taken either to close or re-equip this station. The station is approaching the end of its natural life with present equipment, although it will probably be kept in operation as long as the present power shortage continues. The possibility of replacing the present plant with new turbines and boilers has been investigated, but it appears that Forest of Dean coal which is used is nearing exhaustion and coal would have to be transported from a distance.

Load Spreading Unlikely in North-East

It is not expected that any power cuts or load spreading arrangements will be needed in the North-East this winter, but arrangements have been made to adopt such measures if the winter proves severe. The Northern Regional Board for Industry, in an announcement on the subject, urges all firms with private generating plants to continue to use these during peak hours.

Electricity Sales in July

The accompanying table shows the amount of electricity sent out by the Area Boards during July. The national figures show an increase over July, 1952, of 8·5 per cent, but when corrected for weather and the number of effective working days the increase is 6·9 per cent. The weather conditions were much colder and there were fewer effective working days than in July, 1952.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for July			Totals for Twelve Months Ended 31st July		
	1952 Mill. kWh	1953 Mill. kWh	Increase or Decrease %	1952 Mill. kWh	1953 Mill. kWh	Increase or Decrease %
London	319·0	347·2	+ 8·8	5,211·7	5,685·3	+ 9·1
South Eastern	195·2	218·9	+ 12·1	3,005·5	3,305·2	+ 10·0
Southern	231·6	257·9	+ 11·4	3,475·8	3,863·4	+ 11·2
South Western	116·0	130·5	+ 12·5	1,684·6	1,856·9	+ 10·2
Eastern	318·3	350·2	+ 10·0	4,869·8	5,365·8	+ 10·2
East Midlands*	291·3	320·2	+ 9·9	4,206·5	4,576·6	+ 8·8
Midlands*	394·4	412·6	+ 4·6	5,762·1	6,083·5	+ 5·6
South Wales*	264·5	275·8	+ 4·3	3,212·2	3,329·2	+ 3·6
Merseyside and N. Wales*	232·2	244·7	+ 5·4	3,399·4	3,386·3	— 0·4
Yorkshire*	403·1	418·5	+ 3·8	5,549·5	5,941·8	+ 7·1
North Eastern*	243·0	263·5	+ 8·4	3,492·2	3,566·5	+ 2·1
North Western*	418·4	460·3	+ 10·0	6,372·8	6,526·7	+ 2·4
South East Scotland	74·4	81·3	+ 9·3	1,193·3	1,264·4	+ 6·0
South West Scotland*	171·9	184·9	+ 7·7	2,883·8	3,058·3	+ 6·1
Total all Area Boards	3,673·3	3,966·5	+ 8·0	54,319·2	57,809·9	+ 6·4
Direct Supplies by Central Authority	60·2	83·9	+ 39·4	713·7	855·1	+ 19·8
Grand Total	3,733·5	4,050·4	+ 8·5	55,032·9	58,665·0	+ 6·6
Mainly Industrial Areas Marked*	2,418·8	2,580·5	+ 6·7	34,878·5	36,468·9	+ 4·6
Mainly Non-Industrial Areas	1,254·5	1,386·0	+ 10·5	19,440·7	21,341·0	+ 9·8
Total Number of Effective Working Days	27·97	27·79				

* Over half the total sales by these Boards in the preceding financial year were to industrial consumers.

Electro-Mechanical Devices

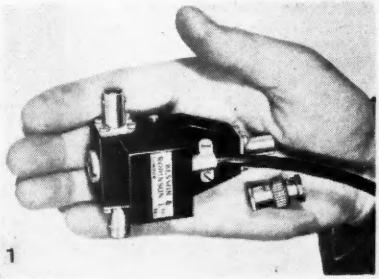
New Company's Range of Products

THE other day we visited a comparatively new company, Besson & Robinson, Ltd., at 6, Government Buildings, Kidbrooke Park Road, London, S.E.3, which makes electro-mechanical apparatus. The main object of the company is to meet the need for the smaller type of mechanism such as relays and wave-guide components, built to the high standard required for the armed Services and the more arduous industrial applications.

A large part of the company's work is the production of micro-wave coaxial and other precision apparatus units used in radio and radar equipment for various governments, an example of which is shown in Fig. 1. This is a coaxial change-over relay for use in aircraft which is matched throughout to the line impedance. For a given dielectric, the impedance in a coaxial line with circular conductors is determined by the ratio of their diameters and this can be calculated by a well-known formula. In this relay, however, the moving contact is carried on a long flat blade placed in a passage-way with flattened sides. A formula, however, has been evolved for this flattened form of transmission line by means of which the correct dimensions can be calculated for relays of almost any desired impedance.

The company has also introduced a range of relays for industrial use. The first of these is the C.01 (Fig. 2), which is a laminated frame relay for operation on a.c. or d.c. Two of its main features are the interconnection of a small resistor with the coil windings which prevents armature bounce and a new method of shading the armature which makes the relay inherently silent on a.c.

This relay has a stainless steel armature hinging pin running in "Oilite" bearings and of very low coil consumption—even when 12 pairs of contacts are fitted the relay only requires 0·6 watt on d.c. and 5 VA on a.c. All the materials and finishes are to the standard of the Inter-Services Specification RCS.1000, but the extra cost of this is more than offset by the ease with which this relay is assembled and as a result prices of the apparatus are competitive.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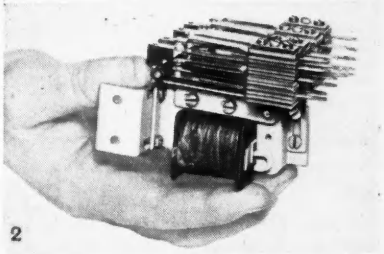
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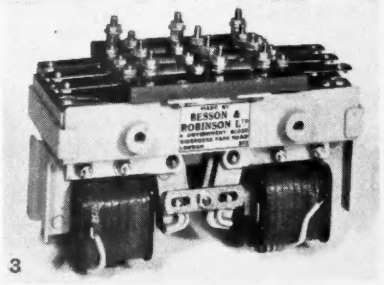

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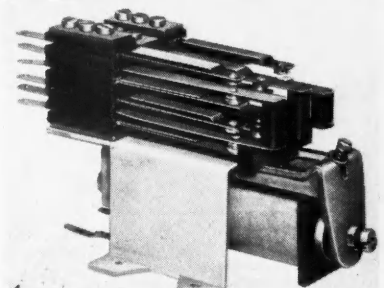
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(1) Coaxial change-over relay. (2) Laminated frame relay for a.c. or d.c. operation. (3) Reversing contactor for controlling motors of up to 1 h.p. (4) B.02 industrial relay

The C.01 chassis can also be employed as a "solenoid" (it will pull 1¼ lb through ⅝in) and it is being used as a basis of several other types of relays. Fig. 3 shows a compact reversing contactor using two of these chassis. The C.04 unit measures 3in by 5¾in by 4in, has positive mechanical interlocking, and can be used to control single- or three-phase motors up to about 1 h.p. It can also be used for other applications where a three-position relay is required.

Another version of the C.01 relay has heavy duty make, break or changeover contacts rated at 15 A and 250 V a.c. with sufficient travel for switching any a.c. or d.c. mains voltage.

The B.02 relay (see Fig. 4) is intended to combine the advantages of the K.3000 type with the additional robustness and insulation required for industrial applications. For instance, it has a centre of gravity fixing bracket and contact assemblies which can be used safely at 500 V. A feature of these relays is that they can be supplied with screw adjustment of both armature gap and contact pressure and one model is available with a special pole which enables the fall-off voltage to be brought very near to the pull-up voltage.

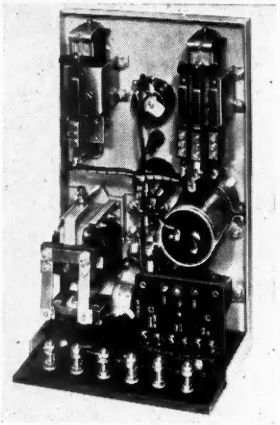


Fig. 5.—Rear of relay/condenser timer

One of the many types of relay/condenser timers made by the company is shown in Fig. 5. This one is used to control in sequence the heating and cooling times of a polythene bag making machine. Timers of this type can control times between about 0·05 sec and 2 min and simpler forms are used in many switchgear applications where a short delay is needed

British Telephone Service

THE Post Office has recently installed the six millionth telephone and there are now twice as many telephones in this country as there were in 1938. Telephones are now being put in 50 per cent faster than before the war and nearly a million new connections have been made in the past three years. This is being done despite the unprecedented demand for telephone service and the restriction on the money allowed to be spent on expansion. Last year, for instance, there were requests for nearly 350,000 installations.

This great expansion of the telephone service has been achieved by a comparatively smaller engineering staff. In 1923, when there were just over one million telephones, the engineers numbered 22,000 and on 1st July, 1953, the engineering staff numbered 64,000. This means that although the number of telephones since 1923 has increased sixfold, the number of engineers has increased only threefold. The main reason for the relative reduction in staff lies in higher efficiency due to modern improvements such as the installation of automatic, mechanical and electrical devices, and the use of electronic cable locators and modern tools like mechanical excavators, utility vehicles, and so on.

The telephone waiting list is now 408,000, a reduction of 60,000 during the past year. One factor which has helped in the reduction of the waiting list is the shared service. Some 600,000 people now have a shared service and about half of these would still be waiting had there been no such facility. There are now about twelve telephones per one hundred of the population and there has been a tremendous increase in telephone traffic. In 1913 the effective inland calls numbered 797,000,000; in the year ended 31st March last the figure was nearly 3,500 million—more than four times as many. To handle all this traffic there are now 6,000 telephone exchanges and 19,000 telephone circuits over 25 miles in length in use in the public network. The time taken to connect trunk and toll calls is now a third less than it was before the war. The number of public telephone call offices has risen from 16,487 in 1923 to 61,807 at the present time. The number of rural call offices has increased by nearly 50 per cent in the last five years.

House Modernizing Experiment

WE have received a copy of an 80-page booklet entitled "The Stockton Test" describing an experiment in house modernization recently carried out by Allied Ironfounders, Ltd. at Stockton. The provision of improved amenities involved includes greater facilities for utilizing electricity, especially for supplying hot water. Copies of the booklet are obtainable free from Mr. N. G. Street, Allied Ironfounders, Ltd., 28, Brook Street, London, W.1.

Lighting Notes

A DEMONSTRATION of fluorescent street lighting, believed to be the first in Canada, was given recently in Queen Street, OTTAWA, in support of a paper read by Mr. W. F. S. Debenham, of the G.E.C. Exterior Lighting Department, London. Five lanterns, each housing three 5ft 80 W lamps, were supplied by the British General Electric Co. (Canadian), Ltd.

The decisive factor hitherto preventing the use of fluorescent street lighting in Canada has been the extremely low temperatures to which the lanterns and lamps would be exposed in winter. This problem has now been overcome and, in addition to the demonstration scheme in Ottawa, four similar G.E.C. lanterns will shortly be erected by the Ontario Highways Department on the Barrie Cloverleaf as a permanent installation.

The cost per head of the population of the public lighting service in SHEFFIELD has risen from 3s 1·3d in 1947–48 to 5s 3·56d last year. This information is given in the annual report of the lighting engineer, Mr. C. J. Chisholm. The number of lamps in use at 31st March last was 28,634, 16,431 electric and 12,203 gas, 301 miles of streets being lighted by the former and 402 by the latter. Of the total expenditure electricity represented 3s 7¼d and gas 4s 2¼d in the £. In a preface to the report the chairman of the Watch Committee (Mr. T. Garnett) says that the experimental sodium lighting in Halifax Road has proved very successful and he looks forward to an extension of the system to other main roads in the near future.

GUILDFORD Corporation is recommended to approve a scheme submitted by the borough surveyor for the provision of 120 80 W mercury vapour lamps at a cost of £4,600 for completing the lighting at Bellfields. It is proposed that the chairman of the Works Committee shall be authorized to accept tenders for lighting schemes for the by-pass road, Aldershot Road and Onslow Street.

ST. PANCRAS Highways, Sewers and Public Works Committee has approved a scheme estimated to cost £2,500 for the improvement of the street lighting in Fortess Road; 140 W sodium lanterns on concrete columns are to be installed, similar to the Highgate Road/Highgate West Hill scheme recently put into operation.

WEST BROMWICH Corporation Highways and Sewerage Committee recommends the acceptance of the quotations of the Midlands Electricity Board for the improvement of the street lighting to Class "A" standard in Walsall Road, Heath Lane, Church Vale, Hallam Street, Seager Street, Reform Street, Bull Street, Spon Lane and Bromford Lane, for the sum of £15,621; to Class "B" standard in Coles Lane, Beeches Road, Dartmouth Street, Claypit Lane, Roebuck Lane, Queen Street, New Street, Hill Top and Bilhay Lane (£5,034); and for the conversion from gas to electricity of lamps in various streets in the borough (£867).

The Minister of Transport has indicated that he is now prepared to consider the installation of improved street lighting in Bath Road, READING. The estimated cost (forty-two 250 W mercury vapour lamps and all the necessary cables) is £3,800.

SOUTH SHIELDS Town Council is to spend £2,055 on improving the lighting in Mowbray Road.

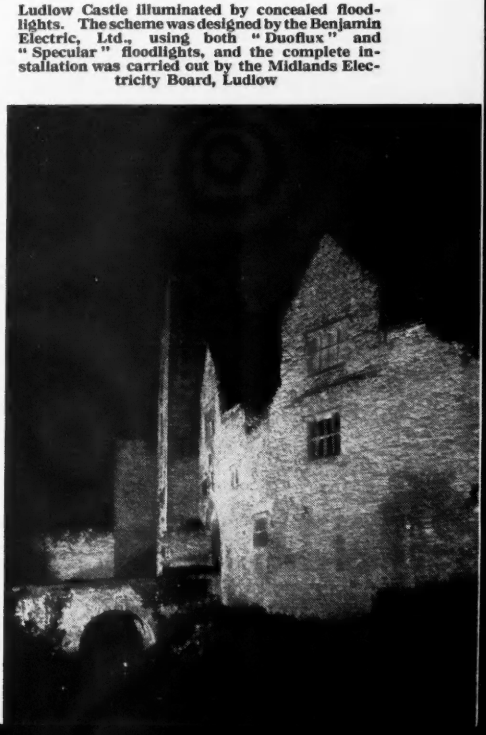
WALLASEY Corporation has been told that the Ministry of Transport is recommending loan sanction for £6,350 for the conversion from gas to electricity of 193 units and the improvement of 33 existing electric units in the Moreton area.

MAIDENHEAD borough surveyor has submitted a scheme for lighting part of the A4 loopway to Group "B" standard at a cost of £2,700.

HYDE Corporation is applying for sanction to borrow £1,514 for street lighting on the Hickenfield estate.

CUCKFIELD U.D.C. is to adopt a scheme of electric street lighting to replace the present gas installation. The cost is estimated at £7,000.

Ludlow Castle illuminated by concealed floodlights. The scheme was designed by the Benjamin Electric, Ltd., using both "Duoflux" and "Specular" floodlights, and the complete installation was carried out by the Midlands Electricity Board, Ludlow



Financial Section

STOCKS and SHARES

BUSINESS in most sections of the Stock Exchange runs steadily, and with a distinct bias towards the bright side. The buyers maintain persistent pressure upon a none too plentiful supply of stock, with the result that although the list of electrical equipment shares presents few major changes this week, the alterations are mainly for the better. The success of last month's issues by the English Electric Co. was confirmed by the announcement that over 96 per cent of the new ordinary shares were taken up by way of rights, and that applications for the small remainder covered nearly two million shares. The quotation remains firm at 4s 10½d premium above the issue price of 48s 6d.

Pye Report

Trading profits of the Pye group increased last year from £786,000 to £956,000. Good as they are, the figures understate the extent to which business expanded, for the annual report says that they were achieved despite a lower margin of profit on the turnover. It is disclosed also that only a small proportion of present production is on account of defence contracts, so that any pruning in these would have no serious consequences. The report states elsewhere the case for commercial television, and indicates that colour television is much nearer than was thought a few years ago. The increased dividend of 20 per cent is shown to be well within earnings, and, in general, the figures furnish the reasons for the quotation of the 5s deferred shares on the relatively modest yield basis of 5¼ per cent.

Anglo-American Telegraph

A statement in the annual report of this company seems to have put an end, for the present at least, to the speculation which has been progressing spasmodically for some time in the " B " ordinary stock. Last year, the price of this issue was run up from under 5 to nearly 18 on the strength of hopeful estimates based on the break-up value in the event of a liquidation. It relapsed last week to about 8 on the directors' reminder that the stock carries no rights of any kind except in a liquidation, a possibility which can be regarded only as remote.

Christy Brothers' Results

The £10,000 increase in net profits announced by Christy Brothers, in respect of the period ended last March, brings the total to £34,000, the best figure recorded since the formation of the present company five years ago. The dividend on the £1 ordinary shares is again to be 7 per cent, in which the new shares issued during the course of the year participate to the extent of one-third. The distribution is well on the conservative side, for roughly three-quarters of the net surplus appears, from the preliminary statement, to be earmarked for the reserves. Last year's report referred to the developing earning capacity of several of the group's main interests, including the radio relay business and the Alderney electricity undertaking. With the shares quoted at 17s 6d, the return works out at 8 per cent.

Thorn Electrical Figures

Preliminary annual results published last week by Thorn Electrical Industries carry further the consistently upward trend of earnings established in previous years. Out of the £90,000 rise in trading profits, heavier taxation and other charges leave an improvement of £21,000 in the net surplus at £223,000. Most of this is again retained in the business, for with no change in the ordinary dividend rate of 12½ per cent, the amount to be distributed is only about £48,000 net. Late last year, the company issued £500,000 5½ per cent loan stock, which is quoted at par. The price of the 5s ordinary shares hardened to 11s 3d cum dividend.

Watford Electric Bonus

Meetings will be held next month to approve the Watford Electric & Manufacturing Co.'s proposal to distribute a capital bonus in the shape of three new 2s ordinary shares for every five old shares held. This operation will capitalize £52,800 of the reserves, or rather less than one-third of the total (excluding the tax reserve) shown in the last balance sheet. Capital then appeared as £176,000, divided equally between ordinary and preference stocks. As a result of the bonus, this figure will be brought into better alignment with the net book assets of over £340,000. For last year the company distributed 25 per cent from earnings equivalent to 45 per cent on the ordinary capital. The 2s shares have risen 9d to 7s 9d at which the yield on the money is £6 9s per cent.

British Columbia Power

Stocks of the British Columbia Power Corporation, one of the principal Dominion utility undertakings, are largely held in this country. A good deal of interest is consequently taken in the proposal, which was approved a few days ago, for a consolidation of the " A " and " B " classes of shares into a single issue. The intended

effect of this seems to be to the advantage of all concerned, bringing the "B" shares within range of the dividends from which they have been precluded for many years under the present capital structure. Also it would admit the "A" shares into the category which qualifies for double tax relief, a material factor at present-day rates. In the meantime the "A" are quoted at about $67 and the "B" at $16. The indicated yield after the reorganization is in each case approximately 5½ per cent, plus the benefit of the tax relief mentioned.

Company	Dividend Previous	Dividend Last	Middle Price 24th Aug. 1953	Week's Rise or Fall	Est. Yield £	Est. Yield s	Est. Yield d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	88	—	3	8	2
Brit. Elec. 1974/77	3	3	86	+½	3	9	0
Brit. Elec. 1976/79	3½	3½	93	+½	3	15	3
Brit. Elec. 1974/79	4¼	4¼	101¼	—	4	3	9
Calcutta Elec. ..	6†	6†	20/-	—	6	0	0†
East African Power	7	7	24/6	—	5	14	3
Nigerian Elec. ..	10	10	24/-xd	+1/-	8	6	8
Palestine Elec. "A"	5†	Nil	12/6	+1/-	Nil		
Perak Hydro-Elec.	Nil	Nil	17/6	+6d	Nil		
Equipment and Manufacturing							
AberdareCables(5/-)	20	25	16/-	—	7	16	4
Aerialite (1/-) ..	83⅓	88⅓	8/9	—	10	1	10
Allen, W. H. ..	15	15	45/3	—	6	11	3
Aron Elec. Ord. ..	15	20	42/6	−½	9	8	2
Assoc. Elec. Ord. ..	20	20	78/9	—	5	1	6
Automatic Tel. & El.	15	15	58/9	+9d	5	2	0
Babcock & Wilcox	18	18	66/6	—	5	8	5
Baldwin, H. J. (2/-)	25	20	4/3	+3d	9	8	0
Bakelite (10/-) ..	—	12½	19/-	—	6	11	6
British Aluminium	12	12	41/-	+6d	5	17	0
B.I. Callender's ..	9	10	37/-	+6d	5	8	1
British Thermostat (5/-)	30	35	16/3	—		—	
British Vac. Cleaner (5/-)	25	25	12/-	+6d	10	8	4
Brook Motors (10/-)	20	20	33/9	—	5	18	6
Brush Ord. (5/-) ..	10	4	4/3	—		—	
A. F. Bulgin (1/-)	30	30	2/9	—	10	18	0
Burco (5/-) ..	38½	35	18/3	—	9	13	0
Chloride El. Storage	15	20	78/9	−¼	5	1	0
Cole, E. K. (5/-) ..	25	25*	19/9	+3d	6	6	7
Cossor, A. C. (5/-)	Nil	10	10/-	—	5	0	0
Crabtree (10/-) ..	17½	17½	29/-	—	6	0	8
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	11/-	+3d	5	2	3
De La Rue (5/-) ..	35	Nil	8/9	—		—	
Decca (5/-)	112½	150	28/6xd	—	5	5	3*
Dewhurst (2/-) ..	22½	19*	5/6	—	6	18	3
Dictograph Tel.(2/-)	20	20	5/6	—		—	
E.M.I. (10/-) ..	12	12	14/9	+3d	8	2	8
Electrical Components (5/-) ..	20	20	10/-xd	—	10	0	0
Elec. Construction	15	15	52/6	—	5	14	3
Enfield Cable Ord.	7½	5	21/3	—	4	14	0
English Electric ..	15	15	52/6	—	5	14	3
Ericsson Tel. (5/-)	22†	22*†	38/6	—	2	17	6†
Ever Ready (5/-)	35	35	25/6	—	6	17	9
Falk Stadelmann	15	15	41/6xd	−6d	7	4	7
G.E.C. Ord.	22½	11½*	38/9	—	5	18	2
General Cables (5/-)	30	30	16/3	−6d	9	4	8
Greenwood & Batley	15	17½	40/-	—	8	15	0
Hackbridge Cable (5/-)	20	20	12/3	+6d	8	3	4
Hackbridge Hewittic (5/-)	20	20	17/6	−3d	5	14	2
Hall Tel. Acc.(10/-)	10	10	10/-	—	10	0	0
Heurtae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (10/-) ..	20	10½*	17/3	+3d	6	2	2
Hivophane (5/-) ..	15	20*	12/6	—	8	0	0
Hoover (5/-) ..	35	25	24/9	+6d	5	1	0

Company	Dividend Previous	Dividend Last	Middle Price 24th Aug. 1953	Week's Rise or Fall	Est. Yield £	Est. Yield s	Est. Yield d
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	25	15*	13/9	—	5	9	0
Johnson & Phillips	15	15	52/6	—	5	14	3
Lancashire Dynamo	12½	12½*	42/6	—	5	17	8
Laurence, Scott(5/-)	15	15	12/3	—	6	2	6
London Elec. Wire	12½	15	60/9	+9d	4	18	8
J. Lucas	7½	9½	41/3	—	4	8	10
Marryat & S. (2/-)	22½	22½	5/9	—	7	16	6
Mather & Platt ..	12½	15	50/-	—	6	0	0
Metal Industries ..	15	12*	40/3	−3d	5	19	5
Mid. Elec. Mfg. ..	15	15	58/3	−½	5	2	9
Murex	15	15	55/3	—	5	8	6
Newman Ind. (2/-)	10	10	2/3	—	8	17	9
Oldham & Son (1/-)	35	17½*	2/6	—	7	0	0
Parnall (Yate) (5/-)	6	6	4/-	−1½d	7	10	0
Parsons, C. A. ..	10*	12½	71/3	—	3	10	6
Plessey (5/-) ..	22½	25	26/3	—	4	15	3
Pye Deferred (5/-)	18	20	19/-	—	5	5	3
Revo (10/-) ..	27½	27½	16/3	+6d		—	
Reyrolle	10*	12½	61/3	+⅛	4	1	8
Scot. Cable (4/-) ..	32	20*	12/9	+3d	6	5	6
Siemens Ord. ..	10	10	35/-	+1/-	5	14	3
Southern Areas ..	5	6	14/9	+6d	8	2	8
Strand Elec.(5/-)..	17½	17½	8/3	—	10	12	2
Sturtevant (5/-) ..	17½†	18·1*†25/-		+3d	3	12	0
Switchgear & Cowans (5/-)	22½	22½	14/-	—	8	0	9
Taylor, T. (5/-) ..	20	25	20/-	—	6	5	0
T.C.C. (10/-) ..	20	20*	37/-	+9d		—	
T.C. & M.	10	8½*	29/-	—	5	17	3
Telephone Mfg.(5/-)	10	10	7/6	—	6	13	4
Thorn. Elec. (5/-)	10	12½	11/3	+3d	5	11	1
Tube Investments	25	15*	60/9	+9d	4	18	8
Vactric (5/-) ..	Nil	Nil	7/6	—		Nil	
Veritys (5/-) ..	7½	10	4/6	—	11	2	2
Walsall Conduits (4/-)	70	70*	44/6	—	6	5	10
Ward & Goldstone (5/-)	45	45*	39/-	+1/-	5	15	9
Watford (2/-) ..	25	25	7/9	+9d	6	9	0
Westinghouse Brake	14	15	57/6	—	5	4	2
West, Allen (5/-) ..	15	15	11/6	+3d	6	10	0
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord.	—	6	84½	—	7	2	0
Ord.	—	3¾	57½	—	6	10	5
Anglo-Portuguese	8	8	21/3	—	7	10	7
Brit. Elec. Traction: Def. Ord. (5/-) ..	25	35	28/6	−9d	6	2	10
Cable & Wireless: Ord.	8	8	133	—	6	0	4
4% Loan ..	4	4	97	+1/-	4	2	6
Calcutta Trams ..	6†	6†	20/-	—	6	0	0†
Cape Elec. Trams	5	5½	10/6	+6d	10	9	6
Marconi Marine ..	10	10	28/6	—	7	0	4
Oriental Tel. Ord.	16	16	70/6	—		—	
Telephone Props.	8	8	5½	—	1	15	6
Tele. Rentals (5/-)	10	10*	9/-	—	5	11	0

* After capital bonus. † Dividends are paid free of income tax.

The above quotations are based upon the middle prices given in the Stock Exchange Daily Official List

REPORTS and DIVIDENDS

Dubilier Condenser Co. (1925), Ltd.—A summary of the accounts for the year ended 31st March last was given in our issue of 7th August. The chairman, Mr. W. H. Goodman, states that the results for the first three months of the current financial year indicate that competitive trading conditions both in home and overseas markets have been intensified, with consequent reductions in selling prices and without a corresponding saving in operating costs. Therefore it is reasonable to assume that unless turnover can be maintained the margin of profit will be less. To meet these conditions the company is continuing with, and extending, its policy of development and research and the introduction of the most modern manufacturing methods.

Parmiter, Hope & Sugden, Ltd.—Speaking at the annual meeting of the company on 19th August, Mr. E. W. Sugden (chairman) said that increases in cost during the year had been very largely offset by increased efficiency and productivity. On the materials purchased side there had as yet been insufficient reduction in cost to be significant, and in fact it was difficult to see that the upward tendency had yet discontinued. With regard to future prospects, he felt obliged to confirm that there was a very definite recession in the market in which the company's products were prominent. So far this year, although there had been a steady flow of orders, the volume had been inadequate to sustain a repetition of last year's record performance.

Electrical Components, Ltd.—This company's accounts were summarized in our issue of 14th August. In his review, circulated with the full accounts, the chairman, Mr. L. S. Seccombe, mentions the completion of the acquisition of a small subsidiary company in Scotland. He says that the first year's trading of this subsidiary has been reasonably satisfactory and the company seems well situated for expansion. The directors have the capital position under constant review and shareholders will be advised when anything can appropriately be done.

Thorn Electrical Industries, Ltd.—Group trading profits for the year ended 31st March last amounted to £771,292 (compared with £681,169 in the previous year). Deducting all charges, including depreciation of £148,688 (£139,381) and taxation of £324,173 (£283,185), the net profit is £223,259 (£211,819). The directors recommend a dividend of 12½ per cent (same).

Metal Industries, Ltd., reports consolidated trading profits, together with other income, for the year ended 31st March last of £1,776,281, compared with £1,918,623 for 1951-52. After deducting depreciation £223,367 (£219,368), taxation £858,971 (£1,025,852) and other charges the net profit amounted to £618,934 (£612,528), of which £612,070 (£609,179) was attributable to Metal Industries, Ltd. With the balance brought forward the total available was £1,071,080 (£1,064,557). It is proposed to pay a final ordinary dividend of 8 per cent, making 12 per cent on the capital increased to £3,900,000 by a 25 per cent scrip issue in July, 1952. A total of 15 per cent was paid for the previous year on the smaller capital. A sum of £250,000 (£300,000) goes to general reserve and £511,494 (£459,010) is carried forward.

Newton Brothers (Derby), Ltd., recommends a dividend of 10 per cent for the year ended 31st March last on capital of £276,473, as increased by a 75 per cent scrip bonus (against 15 per cent and 1½ per cent special bonus on £157,985 capital). The trading profit was £181,717 (£155,070), with investment income, etc., of £4,557 (£3,314), and there was a net profit, after taxation, depreciation, etc., of £74,537 (£43,690).

Christy Bros., Ltd., announce a group profit of £33,823 for 1952-53 after meeting taxation, against £23,802. The dividend is maintained at 7 per cent and £20,000 is transferred to general reserve. Last year the dividend included 1 per cent deferred from the previous year. The balance carried forward is £30,237 (£27,068).

English Electric Co., Ltd.—In connection with the offer of 1,769,365 new ordinary shares recently made to ordinary stockholders, it is announced that a total of over 3,600,000 shares were subscribed or applied for; over 96 per cent of the rights issue were taken up and more than 4,400 applications for excess shares for a total of nearly 2,000,000 shares were received.

Calcutta Tramways Co., Ltd.—The directors state that the company's accounts for 1952 cannot be completed and a decision on the final ordinary dividend made until a tribunal studying the question of fare increases has reported. All services have now been resumed and revenue is slowly becoming normal.

The Rangoon Electric Tramway & Supply Co., Ltd., has declared an interim dividend of 100 pyas, free of Burma tax, on the ordinary shares, in respect of 1952. A dividend, the first for ten years, of 50 pyas, tax free, was paid for 1951. The Government

of Burma has given formal notice of acquisition of the company's undertakings on 1st October.

The Watford Electric & Manufacturing Co., Ltd., intends to capitalize £52,800 of reserves and make an issue of 528,000 fully paid ordinary 2s shares to existing ordinary shareholders in the proportion of three new shares for every five shares held. The company's capital is to be increased to £350,000 by the creation of 100,000 6 per cent cumulative preference 10s shares and 500,000 ordinary 2s shares.

The Rheostatic Co., Ltd., has declared an interim dividend of 7½ per cent (against 4 per cent). The directors state that the increase is not to be taken as indicating any increase in the total distribution for the year.

The Automatic Telephone & Electric Co., Ltd., has declared an interim dividend of 3 per cent on the ordinary stock (same).

New Companies

R. L. Burchell, Ltd.—Registered 6th August. Capital £1,000. Manufacturers and repairers of and wholesale and retail dealers in radio and television sets and accessories, electrical fittings, etc. Directors: R. L. Burchell (secretary) and C. James. Regd. office: 20, Ninian Park Road, Cardiff.

P. E. Thomas, Ltd.—Registered 8th August. Capital £2,000. Refrigerating, ventilating and heating and air conditioning engineers, general electrical installation contractors, etc. Secretary: Marjorie Evans. Regd. office: Thermal Works, Glan Road,

E.M.D. (Romford), Ltd.—The registration of this company was recorded in our last week's issue. We are informed that the company has been formed with the object of taking over the business of E. & M. Dubois, which has been established for a number of years at 49-51, St. Andrew's Road, Romford, Essex.

Liquidations

Coreley Industries, Ltd., electrical engineers.—Liquidator, Mr. B. J. Bruce, Lower Camberton, Kidderminster, Worcs, appointed by members 15th May.

A. F. Bulgin, Ltd. (Members' voluntary winding-up).—Meeting 22nd September at the offices of A. F. Bulgin, Ltd. (successor company), Bye-pass Road, Barking, Essex, to hear an account of the winding-up from the liquidator, Mr. S. E. Parish. (This notice is purely formal. All creditors of the company have been paid in full.)

Bankruptcies

R. Rosvall, lately carrying on business at The Corner House, St. Giles, Torrington, Devon, engineer and electrician.—Receiving order made 14th August on debtor's own petition.

F. B. Williams, 62, Brynmynach Avenue, Ystrad Mynach, Glam, electrician.—Receiving order made 14th August on a creditor's petition.

R. J. Camden, carrying on business at 32, New Bridge Street, Exeter, electrical engineer. Trustee, Mr. G. C. Ehlers, 28, Baldwin Street, Bristol, 1, appointed 12th August.

J. L. Parker, 15, West Street, Horncastle, Lincs, electrician.—Second and final dividend of 1s 1d in the £ payable at the Official Receiver's office, 22, Regent Street, Park Row, Nottingham.

E. Vasey, 21, Bridge Road, Bishopthorpe, York, electrician.—Receiving order made 17th August on debtor's own petition.

TRADE MARKS

RECENT applications for the registration of trade marks include the following, objections against which may be entered up to 12th September:—

HALCYON. No. 717,482, Class 7. Floor polishing machines (not for domestic purposes), spraying machines and machines for drilling, sanding and polishing, all being electrically operated. No. 717,483, Class 9. Electrically driven vacuum cleaning and polishing machines for domestic purposes.—Halcyon Radio, Ltd., Sterling Works, Dagenham, Essex.

GOLDEN SPINNEY (design). No. 717,707, Class 7. Cleaning, drying, hair-dressing, mangling, mincing, mixing, washing and wringing, vegetable grating and cutting, meat chopping, dough kneading, etc., machines, coffee mills, electric motors (other than for land vehicles), brooders for raising poultry; and parts.—Littlewoods Mail Order Stores, Ltd., Waterloo Buildings, Cases Street, Liverpool, 1.

PREMIER. No. 703,835, Class 9. Kits of parts (sold complete) for making wireless and television receiving apparatus, sound reproducing and sound amplifying apparatus.—B. H. Morris & Co. (Radio), Ltd., trading also as Premier Radio Co., Furnival House, 14/18, High Holborn, London, W.C.1.

MISS BY-WAY. No. 708,104, Class 9. Flat irons and vacuum cleaners, electrically operated. No. 708,105, Class 11. Wash boilers, heating stoves, refrigerators, electric fires and lamps for ordinary lighting purposes.—A. J. Norton & Sons, 28, Key Hill, Birmingham, 18.

LUMINITE. No. 709,679, Class 9. Electric storage batteries.—Allied Battery Co., 57, Elthorne Road, London, N.19.

BLUE STAR. No. 713,930, Class 9. Electrical apparatus included in Class 9 for controlling the use of fluorescent lighting systems by current control.—Saxon Components, Ltd., 66, Victoria Street, London, S.W.1.

ECETHERM. No. 718,151, Class 9. Electric heating elements included in Class 9. No. 718,152, Class 11. Electric heating elements included in Class 11.—C. Conradty, Nuremberg. Address for service: c/o Abel & Imray, Quality House, Quality Court, Chancery Lane, London, W.C.2.

ENSYNAMEL. No. 718,608, Class 9. Electric wire covered with insulating enamel.—Enfield Cables, Ltd., Mill Marsh Lane, Brimsdown, Enfield, Middx.

DURATHERM. No. 719,065, Class 9. Insulated electric wire and electric cables.—Duratube & Wire, Ltd., Faggs Road, Feltham, Middx.

Design including the words "Ever Ready Batteries for life." No. 718,414, Class 9. Electric batteries.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

Turkey's Electrical Imports

Increased Purchases of Power Plant

AS expected from the big electrical developments which have been under way in Turkey, imports of power plant rose in value last year by about one third on 1951. Other notable advances were in armoured cables and X-ray apparatus, but telephone business declined. In the electrical import trade many countries competed; German recovery made further progress while Britain's share was fairly well maintained in most lines. Turkey contemplates the construction of many more power stations, and recently we reported the placing of a contract for doubling the Catalagzi plant by the installation of three 20 MW sets.

The accompanying table compares the values in 1952 and 1951 of the principal electrical material imported into Turkey. (£ = 7·875 Turkish lira.)

Class of Equipment	1952 Lira (000)	Inc. or dec. on 1951 Lira (000)
Motors, dynamos, magnetos, etc., up to 10 kg.	678	+ 187
From W. Germany	193	+ 69
„ Switzerland	14	+ 11
„ United Kingdom	281	+ 85
„ Belgium	24	+ 22
„ United States	40	— 22
Motors, dynamos, magnetos, etc., 10–50 kg.	1,562	+ 364
From W. Germany	595	+ 158
„ United Kingdom	559	+ 245
„ Switzerland	147	— 14
„ Belgium	83	— 3
Ditto, 50 to 1,000 kg.	3,956	+ 1,492
From W. Germany	2,054	+ 862
„ United Kingdom	1,004	+ 658
„ Switzerland	132	+ 16
„ Belgium	119	— 62
„ United States	110	— 105
Ditto, 1,000 to 5,000 kg.	2,139	+ 489
From W. Germany	1,336	+ 328
„ United Kingdom	473	+ 197
„ Italy	101	— 1
Ditto, over 5,000 kg.	1,658	+ 469
From W. Germany	1,122	+ 355
Transformers, resistances, etc., up to 10 kg.	3,355	+ 612
From W. Germany	1,064	+ 83
„ Belgium	395	+ 129
„ Netherlands	216	— 31
„ Italy	286	+ 164
„ United Kingdom	740	+ 270
„ United States	276	— 79
Ditto, 10–50 kg.	696	— 70
From W. Germany	98	— 49
„ United Kingdom	226	— 174
„ United States	207	+ 180
Ditto, 50 to 1,000 kg.	1,713	+ 558
From W. Germany	438	+ 92
„ Switzerland	286	+ 178
„ United States	466	+ 178
Ditto, 1,000 to 2,000 kg.	562	+ 179
Ditto, 2,000 to 5,000 kg.	873	+ 111
From W. Germany	239	+ 65
„ United Kingdom	286	— 97
Fans, vacuum cleaners, etc.	822	+ 374
From United Kingdom	343	+ 219
„ W. Germany	269	+ 113
Telephone equipment and parts	2,072	— 967
From W. Germany	820	+ 80
„ Sweden	552	— 1,241
„ Belgium	34	— 133
„ Netherlands	187	+ 145
Telegraph equipment and parts	81	+ 56
From W. Germany	66	+ 53
„ United Kingdom	15	+ 8
Radio transmitters (telegraph) and parts	45	— 4
From United States	39	+ 1
Radio receivers (telegraph) and parts	57	— 7
From United States	37	— 23
„ United Kingdom	19	+ 15
Radio transmitters (telephone) and parts	23	— 223
From United States	23	+ 17
Radio receivers (telephone)	24,700	+ 3,830
From W. Germany	10,364	+ 4,104
„ Netherlands	4,924	— 653
„ Denmark	1,304	— 660
„ France	1,209	— 487
„ United Kingdom	2,517	+ 1,094
Radio parts	1,928	— 364
From Netherlands	432	— 250
„ United States	248	— 370
„ United Kingdom	447	+ 247
Electro-medical apparatus and parts	678	+ 6
From W. Germany	404	+ 119
„ United Kingdom	86	+ 38
„ United States	60	+ 19
X-ray apparatus	1,888	+ 744
From W. Germany	786	+ 337
„ Netherlands	669	+ 391
„ United Kingdom	285	+ 65
X-ray accessories	980	+ 104
From United Kingdom	274	+ 39
„ Belgium	283	+ 125
„ United States	261	+ 13
Accumulators and parts	2,689	+ 877
From W. Germany	1,918	+ 938
„ United Kingdom	427	+ 105
„ Sweden	148	— 45
„ United States	87	— 65
Batteries	5,524	+ 1,502
From W. Germany	1,165	+ 95
„ United Kingdom	3,858	+ 1,382
Wire and cable, insulated with rubber, asbestos, paper, etc.	929	— 1,368
From W. Germany	376	— 270
„ United Kingdom	203	+ 5
Ditto, silk or rayon insulated	1,281	+ 933
From W. Germany	556	+ 399
„ Italy	573	+ 572
Ditto, insulated and metal armoured	9,997	+ 6,873
From W. Germany	1,890	+ 501
„ United Kingdom	6,447	+ 5,589
„ Italy	963	+ 915

Supply in Northern Ireland

Uneconomic Development Curtailed

IN recent years a considerable programme of development has been undertaken by the Electricity Board for Northern Ireland. Financial conditions prevailing last year, however, made it necessary for the Board to review its programme and limit extensions to those giving an economic return; supplies in the national interest; and certain rural works of an unremunerative nature. Another factor affecting the Board's operations in 1952 was a recession in industry (particularly textiles) which resulted in a lower rate of expansion in sales—4·1 per cent against 15·7 per cent in each of the two preceding years. The value of appliances sold also fell considerably and Mr. Lendrick McMaster, M.B.E., the Board's secretary, comments that " there can be no doubt that selling prices of appliances had reached figures beyond those which consumers were prepared to pay."

The Board's Ballylumford generating station and the Harbour power station of the Belfast Corporation were again run conjointly to afford supplies to the respective systems (for a small section of the Board's north-west area supplies were, as formerly, provided by the Londonderry Corporation's station and the Board's Limavady hydro-electric station). At Ballylumford 420·5 million kWh was generated. Proposals for hydro-electric schemes on the Rivers Bann and Mourne were agreed to in principle.

Farming Methods

A total of 359 million kWh was purchased by the Board from the Joint Electricity Committee and 303·1 million kWh was sold. Consumers at the end of the year numbered 117,489, an increase of 7,983 (2,829 urban and 5,154 rural). Included in the additional rural consumers were 1,328 farms, bringing the total number connected to 6,518. Dealing with this aspect of development, the Board's report mentions that a number of farmers and smallholders have adopted lighting for extending the laying period of poultry and infra-red lamps or floor warming have also been installed for the rearing and fattening of pigs. Reports received are said to indicate the likelihood of increased use of electricity in these ways. Experience in some cases has shown that under conditions of electric warmth mortality can be reduced between farrowing and weaning from the order of one in four to about one in ten. In one case a farmer who used electric warmth continuously throughout the winter fattening period found that the saving in food exceeded the cost of electricity, and there was the further advantage of shortening the fattening period. Every effort has been made to bring to the notice of rural dwellers the many uses of electricity.

The capital cost of rural electrification works carried out last year was £360,222, and on the basis of restricting new schemes mainly to those of a remunerative character additional extensions were approved estimated to cost £141,189 for supplies to 1,547 rural dwellings and 100 other applicants including churches, schools and industrial establishments.

Total capital expenditure during the year amounted to £829,243 (making £14·5 million to date), of which £391,225 was for h.v. transmission and £349,716 for l.v. distribution. Approximately 141 miles of h.v. lines and 217 miles of l.v. distributors were constructed.

Financial Position

The Board's accounts show that revenue income increased from £1,944,449 in 1951 to £2,288,750 last year, partly as a result of the higher tariffs which came into operation at the beginning of last year. With the average price of coal at 69·58s a ton the coal clause charge, adjusted to the new basis of 65s, was 0·05d/kWh. The average price obtained per kWh sold rose from 1·54d to 1·75d. Working expenditure amounted to £1,589,269 (against £1,429,573) and after meeting interest and sinking fund contributions there was a surplus of £1,010.

Reference is made in the report to the numerous public lighting improvements being undertaken in the area, including one complete fluorescent lighting scheme. Altogether the number of electric public lamps increased from 11,399 to 13,286.

In conclusion, the report says it is clear that a considerable demand for development exists in all parts of the area; this the Board will meet as soon as prudent finance permits.

Since the end of the period covered by the report the financial position has been altered by the introduction of legislation restoring the system of requiring a guaranteed revenue before undertaking extensions which was in operation before 1948.

Electrical Commercial Travellers

A general meeting of the Electrical Trades' Commercial Travellers' Association will be held at the Feathers Hotel, Broadway, Westminster, S.W.1, on Friday, 11th September, at 6.30 p.m.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 7th October, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

7993. Revo Electric Co., Ltd., and Felton, A. E.—Electric cooking ovens. 22nd May, 1950. (697952.)

20475. Pye, Ltd.—Thermostatically controlled quartz crystals. 24th July, 1950. (698076.)

32613/4. Philips Electrical, Ltd.—Electrical rectifying systems. 20th December, 1949. (698078/9.)

33444. Rolls-Royce, Ltd.—Electrical ignition systems of gas-turbine engines. 11th December, 1950. (697953.)

1950

3383. British Insulated Callender's Cables, Ltd.—Manufacture of electric cables. (698043.) 3384. Method of attachment of a hauling line to an end of a tube, applicable to the manufacture of electric cables and to other tube drawing operations. 8th February, 1951. (698044.)

12327. Telefonaktiebolaget L. M. Ericsson.—Telephone system comprising selector units built up of primary and secondary cross-bar switches. 17th May, 1950. (698177.)

16267. General Electric Co., Ltd., and Benbow, C. H.—Contact banks for electromagnetic switches. 8th July, 1952. (698115.)

17361. Pye, Ltd.—Television apparatus. 11th July, 1951. (697966.)

17924. Pye, Ltd.—Prevention of sparking in electric switches. 24th July, 1950. Divided out of 698076. (698089.)

27228. British Insulated Callender's Cables, Ltd.—Method and apparatus for applying metal sheaths to electric cables. 6th November, 1951. (698045.)

28691. Corning Glass Works.—Methods of and machine for sealing electrically conductive elements into glass envelopes. 23rd November, 1950. (698052.)

1951

1538. Siemens Bros. & Co., Ltd.—Electrical circuits including biased rectifiers. 18th January, 1952. (698195.)

1838. British Thomson-Houston Co., Ltd.—Artificial resins and varnishes. 24th January, 1951. (698196.)

6161. Philips Electrical Industries, Ltd.—Circuits for use in telephone systems. 14th March, 1951. (698054.)

6666. General Electric Co., Ltd., Beggs, S. S., and Powley, M. J.—Lighting fittings. 19th March, 1952. (698128.)

6778. British Insulated Callender's Cables, Ltd.—Manufacture of electric cables. 20th March, 1952. Addition to 581830. (698055.)

10431. General Electric Co., Ltd., Bowles, E. G., and Miles, E. E.—Apparatus for coating tubular fluorescent lamps. 28th May, 1952. (697998.)

10720. General Electric Co., Ltd., and Miles, E. E.—Apparatus for coating tubular fluorescent lamps. 5th May, 1952. (697999.)

10808. Laurence, Scott & Electromotors, Ltd., and Woods, J. V.—Electrical frequency convertor arrangements or systems. 6th May, 1952. (698134.)

11505. General Electric Co., Ltd., Birch, R. G., and Campbell, B. D.—Manufacture of electrically resistive material. 16th May, 1952. (698210.)

12494. Radio Corporation of America.—Television apparatus. 28th May, 1951. (698104.)

14220. Western Electric Co., Inc.—Electron-discharge devices. 15th June, 1951. (698005.)

20868. Gretener, E.—Apparatus for projecting television pictures. 4th September, 1951. (698107.)

21901. Lumalampan Aktiebolag.—Tubular lamp fittings. 18th September, 1951. (698220.)

22083. Telefonaktiebolaget L. M. Ericsson.—Bolometers. 20th September, 1951. (698221.)

23513. Marconi's Wireless Telegraph Co., Ltd.—Frequency modulated communication systems. 9th October, 1951. (698018.)

23730. Metropolitan-Vickers Electrical Co., Ltd.—High-speed control of electrical machines. 11th October, 1951. (698064.)

26053. Solvay et Cie.—Electrolytic cells. 7th November, 1951. (698160.)

26953. Metropolitan-Vickers Electrical Co., Ltd.—Protective arrangements for d.c. dynamo-electric machines. 16th November, 1951. (698065.)

28194. Sylvania Electric Products, Inc.—Ovens for heating elongated vitreous articles. 30th November, 1951. (697836.)

28431. Metropolitan-Vickers Electrical Co., Ltd.—Electrical equipment comprising a plurality of Ward-Leonard systems. 4th December, 1951. (698067.)

29469. Standard Telephones & Cables, Ltd.—Terminating devices for electromagnetic waveguides. 17th December, 1951. (697892.)

29489. France, H. G. M. de.—Colour television systems. 17th December, 1951. (697711.)

1952

865 & 1663. Babcock & Wilcox, Ltd.—Combustion apparatus. 11th and 21st January, 1952. (697838 & 697941.)

1975. Sandoz, Ltd.—Electric cables. 24th January, 1952. (698068.)

2740. Fernseh Ges.—Cathode-ray tubes. 1st February, 1952. (697942.)

2750. Philips Electrical Industries, Ltd.—Circuit arrangements for automatic gain control. 1st February, 1952. (697897.)

4054. Smitsvonk, N.V.—Electric ignition systems. 15th February, 1952. (698230.)

4222. Westinghouse Electric International Co.—Pressure sensitive electrical apparatus. 12th November, 1948. Divided out of 698035. (698069.)

4841. Standard Telephones & Cables, Ltd.—Material for use in electric discharge tubes. 25th February, 1952. (697945.)

6957. Beckman Instruments, Inc.—Electrical apparatus for measuring a characteristic of a material. 18th March, 1952. (697899.)

7731. Westinghouse Electric International Co.—Control systems for direct current motors. 26th March, 1952. (697947.)

9042. Babcock & Wilcox, Ltd.—Pulverized fuel furnaces. 9th April, 1952. (697840.)

9126. Deutsche Gold- und Silberscheideanstalt, Vorm. Roessler.—Production of pure selenium. 9th April, 1952. (698228.)

10499. Edison Swan Electric Co., Ltd.—Electron tube sockets. 25th April, 1952. (698029.)

12040. Hazeltine Corporation.—Wide-band direct-current repeater. 12th May, 1952. (698110.)

15230. British Thomson-Houston Co., Ltd.—Electrical measuring apparatus. 17th June, 1952. (697950.)

26035. Automatic Telephone & Electric Co., Ltd.—Telephone instruments. 4th May, 1951. (697780.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—2nd October. City Council. Supply of two-phase, three-wire watt-hour meters. (E.S.B. 1588/53. Ten/6920.)*

MELBOURNE.—9th September. State Electricity Commission of Victoria. Apparatus to couple existing power line carrier systems to the 220 kV transmission line being erected between Eildon and Kiewa. (E.S.B. 1786/53. Ten/6935.)*

Bilston.—8th September. Borough Council. Supply of 47 250 W h.p. mercury discharge lamps on concrete columns, together with a small amount of Group B lighting in side streets. Borough surveyor, 20, Wellington Road.

Bridgnorth. — 19th September. Borough Council. Supply of 54 Class B lighting standards, with 100 W tungsten lamps, and other equipment, at the Grove housing estate. Borough surveyor, College House.

Buxton.—7th September. Town Council. Street lighting. (See this issue.)

India.—BOMBAY.—22nd September. Electric Grid Department, Government of Bombay. Line materials for the North Gujarat electric grid scheme. (E.S.B. 1564/53. Ten/6938.)*

London. — 25th September. India Store Department. Aircraft electrical stores. (See this issue.)

Loughborough. — 8th October. Borough Council. Electrically driven centrifugal pumping plant (contracts 4 and 5); and dual fuel engines, alternators, electric immersion heaters, circulating pumps, heat exchangers, etc., together with cables, switchgear, etc. (contract No. 7), for sewage disposal works extensions. W. Granger, borough surveyor, Southfields.

New Zealand.—WELLINGTON.—6th October. Post and Telegraph Department. Three miles of rubber insulated and lead (alloy B) sheathed leading-in cable, 1 pair/40, to British Post Office Specification No. CW. 19E. (E.S.B. 1731/53. Ten/6948.)*

Northern Ireland.—14th September. Northern Ireland Housing Trust. Electrical installations in the following dwellings:— 477 at Newtownards, 46 at Larne, 36 at Armagh, and 24 at Ballymena. Offices of the Trust, 12, Hope Street, Belfast.

ANTRIM.—12th September. Holywell Hospital Management Committee. Stage III of conversion scheme of electrical installations from d.c. to a.c. at hospital. F. D. Brown & Sons, consulting engineers, 93, Ann Street, Belfast.

DOWN.—3rd September. County Education Committee. Electrical installation at Holywood Primary School. Munce & Kennedy, architects, 133, University Street, Belfast.

Slough.—11th September. Borough Council. Supply of 130 lamp columns together with the installation of 80 W mercury vapour lighting equipment at various sites within the borough. Borough surveyor, Town Hall.

South Africa.—JOHANNESBURG.—3rd September. Stores Department, South African Railways. High temperature, horizontal box type, electric furnace, suitable for general heat treatment of aircraft components. (E.S.B. 2062/53. Ten/6943.)*

Stockton-on-Tees.—10th September. Corporation. Conversion to mains supply of 6 ton diesel-electric wharf crane. (See this issue.)

United States.—DENVER.—15th September. Bureau of Reclamation. Auto-transformers for Sioux City substation. (E.S.B. 1619/53. Ten/6931.)*

10th September. United States Army Corps. Two 18,800 h.p. water turbines and intake gates. (E.S.B. 327/53. Ten/6834A.)*

Uruguay. — MONTEVIDEO. — 3rd September. Administracion Nacional de Puertos. Turbo-generators and accessories for locomotives of the A.N.P. (E.S.B. 650/53. Ten/5933.)*

Walthamstow. — 11th September. Town Council. Street lighting. (See this issue.)

West Riding.—Applications from electrical contractors for inclusion in the County Council's list of selected contractors to be sent to the county architect by 14th September. (See this issue.)

ORDERS PLACED

Barrow-in-Furness. — Transport Committee. Rewiring of transport depot (£2,923).—North Western Electricity Board.

Hertford.—County Council. Electrical work at Flamstead End Junior Mixed Infants' School, Cheshunt (£1,200).—A. Tindall & Sons, Enfield.

Southall.—Town Council. Recommended. Electrical installations, Montague Road and Norwood Road housing estates (£1,684).—Reed's Electrical (Southall), Ltd.

Southport. — Welfare Services Committee. Recommended. Supply and fixing of an electric passenger lift at "Fairholme," Oxford Road, Southport (£1,415).—Etchells, Congdon & Muir, Ltd.

Worcestershire.—County Council Education Committee. Accepted. Electrical installations at the Pershore Institute of Horticulture (£3,203).—F. H. Wheeler & Co., Ltd.

*Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alston (Cumberland). — Houses (30), Mustard Field; R.D.C. engineer and surveyor, Town Hall.

Barnstaple.—Houses (26), West Sowdon; borough surveyor, The Castle.

Bebington.—First portion of scheme for new town hall in Church Road; L. Birch, borough surveyor, Brackenwood, Bebington, Wirral.

Bedwellty.—Houses (54), at Pengham Road, Aberbargoed; U.D.C. surveyor, Municipal Offices, Aberbargoed.

Bexhill.—Dwellings (156), stage two of Southlands Road estate; borough engineer.

Birmingham.—New premises for the Birmingham Training College for Teachers on 8-acre site in Westbourne Road, Edgbaston (electrical installations estimated at £17,807); H. J. Manzoni, city engineer.

Bradford.—Health centre, Buttershaw estate; city engineer.

Buckhaven. — Hospital, Cameron Bridge; South Eastern Regional Hospital Board, 11, Drumsheugh Gardens, Edinburgh.

Chelmsford.—Showrooms, 4-5, High Street; Geo. Hopkinson, Ltd., 8, Morwell Street, E.C.1.

Chester.—Houses (44), Weston Grove Site, Upton; R.D.C. architect, 16, White Friars, Chester.

Chigwell. — Flats (32), Rectory Lane, Loughton, for U.D.C.; Tooley & Foster, architects, Midlands Bank Chambers, Buckhurst Hill, Essex.

Crompton (Lancs).—Extensions to town hall; U.D.C. surveyor.

Croydon.—Rebuilding St. James's Church Hall; Harold Williams & Partners, surveyors, 80, High Street.

Dagenham.—Factory, Selinas Lane; Capworth Engineering Co., 26, Fanshaw Avenue, Barking.

Dartford.—Houses (89), Temple Hill; borough surveyor, Barclays Bank Chambers, High Street.

Doncaster.—Extensions to St. Catherines Institution, Tickhill Road, for Sheffield Regional Hospital Board; E. F. Wilson, architect to the Board, Old Fulwood Road, Sheffield.

Edinburgh.—Large extensions to bottling factory; William Younger & Co., Ltd., brewers, Holyrood Brewery, 8.

Felling (Co. Durham).—Houses (161) and two shops and flats west of the Ellen Wilkinson estate; U.D.C. chief housing officer.

Hindley.—Fire station (£30,000); county architect, Preston.

Ilford. — Houses (34), Torquay Gardens; Suburban Developments (Ilford), Ltd., 667, Eastern Avenue.

Flats (40), Fencepiece Road; New Ideal Homesteads, Ltd., Mead House, South Street, Epsom.

Ipswich.—Clinic in Meredith Road, Whitton (£22,315); borough surveyor, 19, Tower Street.

Jarrow.—Hostel for old people (£38,701); county architect, Court Lane, Durham.

Kingswinsford.—Hostel for the aged next to Broadfield House; county architect, Stafford.

London.—BLACKFRIARS.—Works extensions; Co-operative Printing Society, Ltd., Surrey Row, S.E.1.

CAMBERWELL.—Flats (234), Denmark Hill; Unit Construction Co., Ltd., 34, St. James's Street, S.W.1.

Margate. — Houses (36), Hundreds Farm estate, Westgate-on-Sea; borough surveyor, 38, Grosvenor Place.

Middlesbrough.—Merchant Navy Club in Marton Road (£25,000); Kitching & Co., architects, 21, Albert Road.

Newby.—New C. of E. church; architect, Major G. G. Pace, York.

Newcastle-on-Tyne.—Houses (28), Kenton North estate; John Twiname, Ltd., Cockermouth.

Nottingham.—Abattoir extensions (£22,000); city engineer.

Technical college (first stage); T. Cecil Howitt & Partners, architects, St. Andrews House, Mansfield Road.

Oldbury.—Flats, Titford estate; borough surveyor.

Peterborough.—Extensions to Dogsthorpe County Secondary Modern School (£82,000); clerk to Joint Education Board, Bridge Street.

Portsmouth.—Houses (56), Billy Lawn site, Leigh Park; city architect.

Prudhoe-on-Tyne. — Houses (101), West Wylam; U.D.C. surveyor, Council Offices, South Road.

Rowley Regis.—Houses (64), Brickhouse Farm estate; R. Hegan, town clerk, Municipal Buildings, Old Hill, Cradley Heath, Staffs.

St. Helens.—Fire station, Ashcroft Street; borough surveyor.

St. Leonards-on-Sea.—Rebuilding Parish Church; A. Gilbert Scott, architect, 3, Field Court, Gray's Inn, W.C.1.

Saltburn.—Houses (16), Coach Road, Brotton, for U.D.C.; W. R. Ellis, surveyor, Council Offices.

Smethwick.—Extensions to Hill Crest home for aged (£20,000); borough surveyor.

Stanley (Co. Durham).—Pithead baths at Tanfield Lea Margaret Pit; N.C.B. Architects' Department, Ashfield Towers, Gosforth, Newcastle-on-Tyne.

Houses (80), Lintz; U.D.C. surveyor.

Stockport.—Branch library at Brinnington estate; W. Dobson Chapman & Partners, architects, Pear Tree House, Jordangate, Macclesfield.

Sunbury-on-Thames.—Secondary grammar school (£162,000); Middlesex county architect, 10, Great George Street, S.W.1.

Wood Green.—Workshops, White Hart Lane; Victor Sheet Metal Works, Ltd., 40, Finsbury Road, N.22.